DETERMINING PUPIL ORIENTATION TOWARD THE NATURAL ENVIRONMENT AND CONSERVATION

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I, the undersigned, hereby declare that this dissertation is my own original work and that it has never been presented in part or in its entirety at this or any other University in order to obtain a degree.

21.11.90

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TO MIRNA, DIRK, MARICI AND CHRISTINE

SUMMARY

The urgency of the issues concerning of man's relationship to the natural environment is confirmed by the large-scale publicity given to them by the media. This has resulted in a fairly general public awareness of environmental issues which is at present reflected by numerous efforts to further stimulate positive interest in conservation and the responsible use of natural resources.

It is generally accepted that the next generation of decisionmakers should be more thoroughly equipped to face these environmental issues and problems, some of which threaten life's very existence. Over the past 15 years, therefore, several organizations have accepted the responsibility of making school-children much more aware of the environment and of encouraging in them a sense of responsibility towards it.

To date, however, these efforts have taken place outside the formal education sector. In fact, there are indications that environmental education has had very little impact on our school programmes. It appears that those school subjects in particular which are supposed to introduce pupils to aspects of the natural environment are still taught as if there were nothing wrong with the environment and as if the environment were just another topic to be studied. Environmental issues are avoided in most current school syllabuses, designed as they are to prepare pupils academically for university or the labour market.

However, there are indications that, particularly as a result of increased public pressure, the formal education sector will eventually have to accept responsibility for assimilating the principles of environmental education into school curricula. The White Paper on Environmental Education (April 1989) seems to support this. It is being generally accepted that environmental education will not be regarded as a new school subject, but that it will re-emphasize classic educational principles aimed at encouraging positive pupil attitudes toward the environment. These attitudes can

be defined by terms such as responsibility, concern, inclination toward conservation, environmental awareness and respect for creation.

It is clear that some basic aspects of attitudes should be investigated in formal education. A cognitive component has long been accepted as a prerequisite for the existence of any particular attitude, while a personal value system is also important. A third is the conative aspect, that is, a tendency to act in a certain way. This implies that the emphasis in formal education will have to shift towards a holistic approach which will acknowledge the importance of these aspects in the learning process.

The crucial role of evaluation and assessment in education has long been accepted. Both serve to not only gather information on the pupils' development, but also expose learning needs and lacunae which should enable the teacher to make informed decisions on curriculum materials and methodology.

Since it seems that environmental education will widely serve as an important stimulant for educational reform, classroom evaluation practice is one of the areas which should benefit from the introduction of this approach. However, evaluation instruments will have to be developed that will enable teachers to collect information on pupil orientation toward the environment and conservation. This will not only enable teachers to develop curricula suited to the needs of pupils and society more effectively, but it may also enable them to monitor the development of positive attitudes in pupils on an ongoing basis. There are indications that in a complex society as exists in southern African culture and ethnicity greatly influence orientation and attitudes toward the environment, and this should be considered in the development of curricula. Therefore these evaluation techniques should be effective in the classroom as well as in a variety of social contexts.

The main purpose of this research project was to develop an evaluation instrument that could be used to gather information to enable the teacher to formulate relevant and suitable curriculum objectives and to choose suitable curriculum materials and methodologies. This may be instrumental in educating a new generation who will be better equipped to address environmental issues and problems than the present one.

This development should be regarded as an attempt to encourage the unforced introduction of environmental education into formal education systems, thereby complying with some of the recommendations in the White Paper.

OPSOMMING

Die dringendheid van die vraagstukke wat die verhouding van die mens tot sy omgewing kenmerk word bevestig deur die grootskaalse publisiteit wat dit in die openbare media geniet. Dit het gelei tot 'n redelik algemene bewustheid van omgewingskwessies onder die algemene publiek, en word tans gereflekteer deur verskeie aksies wat daarop gemik is om groter bewustheid en positiewe aksie verder te stimuleer.

Daar word allerweë besef dat die volgende geslag besluitnemers meer substansiëel toegerus behoort te word ten einde hierdie vraagstukke - sommige waarvan die voortbestaan van lewe self bedreig - die hoof te bied. Verskeie organisasies het oor veral die afgelope 15 jaar die verantwoordelikheid aanvaar om ook die skoolgaande jeug op te voed tot 'n groter bewustheid van, en 'n groter verantwoordelikheid teenoor die omgewing.

Hierdie pogings vind jammer genoeg veral buite die formele onderwyssektor plaas. Daar is trouens talle aanduidings dat omgewingsopvoeding nog geen noemenswaardige weerklank in ons skole gevind het nie. Dit wil voorkom asof veral die skoolvakke wat die kind aan sy natuuromgewing moet bekendstel steeds só onderrig word asof daar niks met die omgewing skort nie, en die omgewing steeds net nòg 'n onderwerp is wat bestudeer behoort te word. Weinig van die vraagstukke wat teruggevoer kan word tot die mens se wanverhouding tot sy omgewing word weerspiëel in huidige skoolsillabusse, wat hoofsaaklik daarop gemik is om die kind akademies vir die universiteits- of arbeidsmark voor te berei.

Alle aanduidings is egter daar dat, veral weens openbare druk, die formele onderwyssektor gaandeweg die verantwoordelikheid sal moet aanvaar om ook die beginsels van omgewingsopvoeding in skoolvakke te integreer. Dit is ook bevestig deur die Witskrif oor Omgewingsopvoeding (April 1989). Dit word algemeen aanvaar dat omgewingsopvoeding nie 'n nuwe vak is nie, maar slegs neerkom op

herbeklemtoning van klassieke onderwysbeginsels met die doel om uiteidelik die leerling se **houdings** ten opsigte van sy totale omgewing positief te beïnvloed. Díe houdings kan op talle wyses omskryf word: verantwoordelikheid, besorgdheid, bewaringsingesteldheid, liefde en deernis vir die skepping, omgewingsbewustheid en ander word gereeld gebruik.

Dit blyk dat daar sekere basiese aspekte van houdings is wat deur opvoeding ondersoek behoort te word. Dit is duidelik dat 'n basiese kenniskomponent 'n voorvereiste is vir die bestaan van 'n sekere houding, en dat die waardesisteme van 'n individu 'n ander belangrike komponent van 'n houding is. 'n Derde komponent is 'n konatiewe, oftewel 'n geneigdheid tot 'n sekere optrede. Dit is duidelik dat die klem in onderwys toenemend sal moet verskuif na 'n meer holistiese benadering wat die rol van hierdie fasette in die leerproses erken.

Dit word algemeen aanvaar dat evaluering 'n uiters belangrike rol te vervul het in onderwys en opvoeding. Nie alleen word inligting ten opsigte van 'n kind se groei en ontwikkeling daardeur gegenereer nie, maar dit verskaf noodsaaklike inligting ten opsigte van sekere leemtes en leerbehoeftes wat by kinders mag bestaan, en wat 'n bepalende invloed op die ontwikkeling van kurrikulums behoort te hê.

Dit word voorsien dat omgewingsopvoeding 'n baie belangrike stimulant vir onderwysvernuwing oor 'n wye front sal bied. Die gebied van klaskamerevaluering is een van die areas wat sal baat by die implementering van dìe benadering, mits tegnieke ontwikkel word om die onderwyser in staat te stel om soveel as moontlik inligting oor sy leerlinge se ingesteldheid teenoor die omgewing en bewaring te genereer. Dit sal hom nie net in staat stel om meer doeltreffend te kurrikuleer nie, maar ook om op kontinue basis die vordering van sy leerlinge veral ten opsigte van die ontwikkeling van positiewe houdings te monitor. Daar is aanduidings dat in die komplekse suider-Afrikaanse samelewing **kultuur en etnisiteit** 'n baie belangrike invloed op die ingesteldheid en houdings van mense ten opsigte van die omgewing het, en dat dit deeglik verreken behoort te word in die ontwikkeling van kurrikula. Om die rede behoort hierdie evalueringstegnieke van sò 'n aard te wees dat dit oor 'n wye spektrum van samelewings effektief aangewend kan word.

Die doel van hierdie navorsing was dus om 'n evalueringsinstrument te ontwikkel wat in die klaskamer aangewend kan word om tersaaklike inligting vir die

onderwyser te genereer. Dit behoort onderwysers in staat te stel om meer doelgerig te werk te gaan ten einde die volgende generasie voor te berei om die talryke probleme wat die mens se verhouding met die natuuromgewing kenmerk meer doeltreffend te hanteer as wat tot op hede die geval was.

Met hierdie ontwikkeling word dus 'n poging aangewend om te verseker dat omgewingsopvoeding op natuurlike wyse in skole ingedra word, om sodoende te voldoen aan van die aanbevelings wat in die Witskrif vervat is.

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CHAPTER 1

INTRODUCTORY ORIENTATION AND RESEARCH MOTIVE

> **"The ability to measure provides a considerable constraint on what teachers come to believe they ought to do" - Elliot Eisner.**

1.1 ACTUALITY OF THE RESEARCH

1.1.1 PERSPECTIVES ON ENVIRONMENTAL EDUCATION IN FORMAL EDUCATION

The need for a new emphasis in formal education has been stimulated by the general realization of the gradual deterioration of the environment, and the degeneration worldwide of a number of life-supporting systems. Food shortages as a result of over-exploitation of natural resources, increasing population, urbanization, overburdening of natural cycles by excessive production of industrial, domestic and agricultural waste, ozone depletion and the impending climatic changes, as well as destruction of natural habitats and the resultant elimination of species diversity are only a few of the issues and problems resulting out of the relationship between man and the environment.

A number of local authors have in recent years enunciated the concept and objectives of environmental education, based on resolutions and guidelines laid down during international and local conferences (Irwin: 1988, Hurry: 1982, Diepeveen: 1982, Fuggle: 1982, Ballantyne and Oelofsen: 1989).

Various conservation agencies have developed and implemented environmental education programmes, thereby providing valuable services to schools. Together with extensive media coverage of local and global environmental issues, these

programmes have unquestionably contributed toward a greater level of awareness among the general public of the built and natural environment and those systems and conditions that sustain life. This has caused increased pressure on education authorities to accept some responsibility in this regard, especially in school curricula that are suited to address issues related to man and his environment.

The White Paper on Environmental Education (1989) is seen to be a direct result of this pressure, its acceptance being generally regarded as a first step both in introducing environmental education as part of the formal curriculum, and in the development of environmental education programmes on a co-ordinated and rationalized basis.

The move toward a stronger focus on environmental education in formal education will both demand and stimulate adaptations to traditional classroom approaches and practices. O'Donoghue (1986:3) summarizes this anticipated influence as follows: "Environmental education might ... be seen as a catalyst that stimulates change within institutions...".

Teachers will not only have to be trained to implement new ideas and approaches, they will have to be supplied with materials and techniques to enable them to incorporate the principles of environmental education into classroom practice.

1.1.2 OBJECTIVES OF ENVIRONMENTAL EDUCATION: IMPLICATIONS FOR TEACHERS

The main objectives of environmental education as formulated in the White Paper are as follows:

3.2.1 To make the population aware of the various elements of the environment and their interrelationships, and of the need for a healthy environment for the survival of mankind.

3.2.2 To motivate people to accept responsibility for the environment and to cultivate the necessary knowledge and values in order that solutions may be found for identified problems (White Paper on Environmental Education 1989: 2).

These objectives provide for the development of **positive value systems** toward the environment and **knowledge** of certain basic concepts related to it, as well as the necessary **skills** to identify and solve problems and use natural resources on a sustainable basis. These objectives can therefore be summarized **as the development in learners of responsible environmental behaviour.** Sia, Hungerford and Tomera (1986:3) confirm this view when stating:

> The aquisition of responsible environmental behaviour has long been recognized as the ultimate goal for environmental education.

As the ultimate goal, this is an ambitious one and one worth pursuing; whether teachers will be persuaded to teach toward its achievement is an open question. Sia *et al.* (*op. cit.*) found that "...an examination of environmental education research and curriculum materials indicates that this goal is not given the emphasis it needs".

The main problem anticipated in the introduction of environmental education in the classroom is how to ensure that teachers

(a) are sensitized as to the importance of educational objectives stated in behavioural and affective terms;

(b) select and apply appropriate materials and techniques to enable pupils to achieve these objectives.

Any efforts to introduce environmental education into formal education without addressing these problems are likely to be futile. This may be due to a number of reasons; one of the most likely is the fact that too often **only that which can be measured, will be taught**. There is reason to believe that the development of new educational material is often determined by the measurability of anticipated outcome. Furthermore, the traditional evaluation practices, being inclined toward the assessment of cognitive outcome alone, often do not lead to improved teaching, but have a negative influence on the teaching style of many teachers, in that most of the efforts are aimed at cognitive learning.

This problem is compounded by the intrinsic difficulties involved in assessing behavioural and affective outcomes of formal education. The important objectives of environmental education are largely behavioural and attitudinal in character. With regard to the importance of recognizing these elements in educational evaluation practices, Jones and Bray (in Lloyd-Jones 1986:27) state:

> It is unreal to disregard the "affective area" ... which is expressed through behaviour (in the broadest sense). Assessment which ignores behaviour is artificial. We also need to be aware that pupils need and deserve assessment in this area.

Yet it is exactly in the domains of attitudes and the relationships between attitude and behaviour that objective measurement is intrinsically difficult, if not essentially impossible.

To ignore these difficulties, and simply assume that any desirable outcome of education is objectively assessable, would be naive and would amount to logical positivism. The following threefold strategy might therefore be appropriate for addressing this problem:

* Sensitizing teachers to the fact that the difficulties involved in the measurement of behavioural and affective objectives in no way distracts from their importance;

* Developing such evaluative instruments, limited though they may be, that may provide some feedback to teachers with respect to the attainment of environmental education objectives. (It would however be important that teachers are brought to realize the limitations of such instruments).

* Developing assessment instruments which, though they may not be appropriate for evaluating the outcome of environmental education programmes, can be used to identify needs for attitudinal changes in learners and teaching techniques.

It is the main purpose of this study to develop an instrument which may serve the latter of the two purposes stated above.

In terms of contemporary research in curriculum development and evaluation, both types of evaluation suggested above serve important functions in education.

* **Needs analyses** form an essential part of a situation analysis, or what Stufflebeam in his CIPP Model for Program Evaluation refers to as **context evaluation** (Stufflebeam 1983:124-6), or Stake refers to as **antecedent**

conditions evaluation (Stake 1983:304). For the environmental educator, this could serve a diagnostic purpose in that he might be enabled to identify learning needs with regard to aspects such as cognitions about, and attitudes toward, the environment.

This information could in turn serve as necessary guidelines for the process of formulating course objectives, and lead naturally to aspects of **input evaluation** which involves the selection of content and approach.

* **Product evaluation** is an integral part of formal education and certainly has an important role. To meet the demands of environmental education, however, instruments should be developed to provide for assessing not only cognitive outcome, but also other elements associated with behaviour.

1.2 RESEARCH OBJECTIVES

In the light of the above, the main objective of this study can be formulated as

the development of an evaluation instrument to enable teachers to investigate aspects of pupil behaviour toward the environment. The instrument should be designed in such a way that teachers could

* **apply it in a needs analysis in order to identify learning needs, particularly with regard to cognitive and affective aspects of pupil behaviour;**
* **use the results of such analyses to formulate course objectives and select appropriate curriculum materials and methodology;**
* **apply it in product evaluation situations in order to assist them in investigating the applicability of curriculum materials and methodology.**

The following will serve as guideline in this development:

> The instrument is intended for use by the teacher as the "researcher", and should therefore be simple and logical, and not dependent on statistical analyses. At the same time, care will be taken to avoid oversimplifications.

The use of the term environment in this study needs clarification. For the purpose of this development, only aspects of the natural environment, and aspects of human influence on these are referred to. This does not imply any limitations on the accepted parameters of environmental education, namely that it deals with the total environment - natural as well as man-made.

1.3 CHAPTER DIVISION

The development of an instrument for the purposes described in the preceding paragraphs is essentially based on both literature study and empirical research. The first four chapters are based on literature study with the aim of describing a suitable theoretical framework, while the last three deal with the development of the instrument and the interpretation of the results of its application.

In chapter two, the objectives and main features of environmental education are discussed in more detail in view of various perspectives found in literature. The main emphasis is on those aspects that make this approach to education an ideal unifying concept for ensuring increased relevance in a number of school subjects.

The relationships between the objectives of environmental education and those of biology are analyzed in order to rationalize the development of an evaluation technique, especially for the life sciences. The objectives of the senior biology core syllabus are critically analyzed with regard to its relevance to environmental education.

Chapter three deals with the objectives of environmental education. As the success of environmental education is judged by the development of positive behaviour toward the environment, efforts are made to analyze aspects associated with the

latter, such as values, attitudes, perceptions and conative aspects. Relationships between these aspects and their respective roles in the learning process are discussed.

A set of working definitions for key concepts are formulated, and based on these, a learning model for environmental education is proposed.

Chapter four deals with the area of behaviour assessment and evaluation. Various recent and current trends and practices in the field of evaluation of aspects associated with environmental behaviour are discussed. Some relevant evaluative designs applied in environmental education situations and suitable research strategies are considered.

Chapter five deals with the rationale and theoretical background of the evaluation technique as well as the development, administration and validation of an evaluation instrument. For this purpose, a group (n = 611) of std. six pupils from black, coloured and white schools was used. The interpretation and coding of the responses is likewise discussed in full detail, and noticeable differences between the groups from different schools identified by the instrument are discussed.

The development of the instrument included finding out whether it could also be applied to identify any improvements in some or all of the aspects associated with attitudes. Its application in a quasi-experimental design using a control and experimental group (the latter exposed to a planned intervention) is described. This exercise was performed to investigate the possible use of the instrument in a product evaluation, and was not primarily aimed at proving the worth of the programme.

In chapter six the processing and interpretation of the test results are discussed. Part of this analysis entailed application of the test results into an adapted version of Newgard's four-dimensional evaluation model designed to categorize pupils into four orientational categories with regard to the natural environment (Newgard 1984). The main purpose of this exercise was to determine whether the instrument differentiates sufficiently with regard to cognitive, affective and conative aspects of pupil attitudes.

Three pilot studies conducted to develop various aspects of the evaluation technique are described in the appendix. The Appendix also contains examples of the relevant questionnaires, coding schemes and tables used.

Although it was not the main purpose to develop a standardized measuring instrument, and therefore statistical analyses are not prerequisites, some statistical programmes were applied to determine the significance of differences identified between groups, and between pre- and post-test results within the same group. The programmes used are the following:

Hotelling's t-squared tests designed to establish whether there were any significant differences between the two test groups *before and after* intervention;

Bonferroni's multiple comparison applied to each individual variable in order to establish which of the three variables were responsible for this difference;

A programme designed for the analysis of ordinal data to determine whether there were significant differences in the distribution of experimental and control respondents over the four orientation categories of the evaluation model.

The development of an instrument of this nature, representing a tentative step toward the development of appropriate evaluation instruments for environmental education will inevitably present a number of difficulties as well as aspects that warrant further research. It is to be expected that most of these will be evident only after the analysis of the results. In the final chapter, these aspects are discussed, and recommendations suggesting further research, development and refinements are proposed.

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CHAPTER 2

PERSPECTIVES ON A THEORETICAL FRAMEWORK FOR ENVIRONMENTAL EDUCATION - IMPLICATIONS FOR BIOLOGY EDUCATION AND EVALUATION

2.1 INTRODUCTION

This thesis does not intend to defend the merits of environmental education, or to make a case for the introduction of this approach into formal education. Over the past twenty-five years our recognition and understanding of the issues and concerns arising from the human exploitation of the environment and the value systems which support such exploitations have been aided by a growing volume of literature and the more popular forms of mass communication (Williams 1985:5). It has become evident that education is increasingly looked upon to address these areas of concern in an effort to restore imbalances that have arisen in the relationship between man and his environment.

In southern Africa, the development and growth of the environmental education movement followed a course similar to that in countries where it has by now become established. Much of the early development and implementation was influenced by patterns followed and research undertaken elsewhere, as well as factors unique to the local situation.

There are, however, circumstances that could seriously impede the general introduction of environmental education in schools. The complex nature of southern African society with its different cultures and the accompanying needs and perceptions, presents a considerable challenge to education reform.

The ideology of apartheid has without doubt had a pronounced negative influence on the normal processes of development and reform in education, thus hampering development of environmental education (Ballantyne and Tooth-Aston 1988). In the first place it has resulted in serious social and environmental problems among a deprived majority, which could take years to solve, and it can also be held partly responsible for a substantial backlog in education facilities for blacks. This creates a

dilemma: while all efforts at present go into ensuring at least a basic education for a majority of people, and addressing basic needs, environmental education can be regarded as an elitist white notion ; "...a fashionable idea imported, like a white hairstyle, with a six month delay from Europe or North America" (Sachs, undated:1).

In a time of political uncertainty, it can only be hoped that the White Paper on Environmental Education (1989) will be accepted as an important document which will positively influence the gradual introduction of this approach into formal education.

The developments that culminated in the publication of this paper in 1989 can be traced to the publication of the **White Paper on a National Policy for Environmental Conservation (1980)** and the adoption of the **Environmental Conservation Act (Act 100 of 1982)** which were to have important implications for education. The **White Paper on the Provision of Education in the Republic of South Africa (1983)** further paved the way.

Not only were the guidelines laid down in the aforementioned documents reflected in the White Paper, but partial cognizance was given to the international congresses held in Belgrade and Tbilisi. Locally, a number of national conferences and workshops, initiated by non-statutory organizations such as the Wildlife Society and the Environmental Education Association of southern Africa were instrumental in developing the early groundwork for the White Paper. The fact that the document was developed on the basis of a variety of international and local perspectives on education and environmental conservation and management could give it some status as a logical and legitimate document. At present, signs are that it has given impetus to and coordinate a movement that has hitherto been slow and uncoordinated.

In this chapter, some perspectives on the theory of education in general, and environmental education in particular, will be discussed to illustrate the point that environmental education should be regarded as a new approach to education, and not as a proposed addition to school curricula. Some areas where this approach will require urgent adaptations, in order to ensure that the objectives are achieved, will be pointed out.

Although the success of environmental education relies on contributions from the entire spectrum of school subjects, biology education has been singled out as having a key role in environmental education, since it represents the main medium through which pupils are introduced to various aspects of life as a phenomenon, and the conditions that sustain life. For this reason, analogies between the objectives of biology and environmental education will be stressed.

2.2 ENVIRONMENTAL EDUCATION: A THEORETICAL FRAMEWORK

Education is described as **"...the aggregate of all the processes by means of which a person develops abilities, attitudes and other forms of behavior of positive value in the society in which he lives"** (McInnis and Albrecht 1975:459). The original meaning of the Latin term from which education was derived ("educare") is "to draw forth". Education can therefore be regarded as **an emergence from within of certain potential capacities.** Dubos (quoted by McInnis 1975:21) explains as follows:

> ...each individual person is as much the product of the environment as of his genetic endowment. Human beings perceive the world, and respond to it not through the whole spectrum of their potentialities, but only through the areas of this spectrum that have been **made functional by environmental stimulation** (emphasis added).

Exposure of a human being to the total human environment therefore enables these inherent potentialities to become capabilities, and this can only happen if and when the environment activates them. Braham has termed this process of realization of inherited capacities "optimization... " as it "... leads to the elaboration of potentialities, as inner resources are tapped, abilities are developed, and the individual is able to offer something to the world" (Braham 1988:11). Furthermore, it is pointed out that these possibilities "... are realized in direct proportion to the quantity, diversity and complexity of the environmental events we **actively** experience" (McInnis *op. cit.*:23).

According to this perspective, the function of the educator is to act as an agent between learner and environment in order to **expose the learner to the various aspects of his environment in such a way that his potential capacities are**

developed. This would enable the person to fulfil his or her role in his social and natural environment.

Braham (*op. cit.*:16) describes the **content** of education by categorizing these potential capacities into five dimensions which can be elaborated on as follows:

2.2.1 **The Physical Dimension.** The development of this dimension should lead to a sense of responsibility toward the environment, and a realization of how humans fit into the scheme of life.

2.2.2 **The Psycho-Social Dimension** refers to a social conscience and a sense of belonging to a community. The development of this dimension makes people aware of themselves and of others who share their concerns and responsibilities, and accept the values and ethics of their community.

2.2.3 **The Aesthetic Dimension** refers to a sense of harmony, order and function. The development of this dimension is vital, as without it, man would be unable to create or to appreciate beauty, balance and harmony.

2.2.4 **The Intellectual Dimension.** This dimension is important, but tends to be overemphasized in formal education. Provision should be made for the learner to acquire a clear understanding of the functioning and power of the human mind in order to comprehend something of human needs, current world crises, the nature of man and his place in nature.

2.2.5 **The Spiritual Dimension.** The development of this dimension satisfies man's search for meaning that transcends ordinary rational thinking. This should be done without being prescriptive with regard to a specific religious path.

In the education systems of Western industrial societies, pupils are probably not exposed to the environment in such a way that a maximum number of potential capacities develop into capabilities. While those physical and mental capabilities that enable man to remember, to foresee, to analyze, to imagine and create and to communicate are being developed, the capacity to appreciate and to act responsibly toward the environment is apparently not developed.

This type of education may be conducive to the overexploitation and wastefullness that characterize many Western societies, and that have also directly and adversely affected Third World environments. "Western" education has in many instances been "sold to", or adopted by Third World countries, which have often been swayed by promises of economic growth and wealth. In many cases, however, this education has had the opposite effect, leading to environmental destruction, serious poverty and social hardship among "... those who are least able to help themselves, and whose indigenous abilities to cope with resource scarcities and environmental stress are already being eroded by forces mostly beyond their control ..."(O'Riordan 1981:4).

Agarwal (1986:166) puts it more strongly when he states: "It is the so-called educated people who need environmental education more than anyone else. The more "educated" you are in the Third World today, the more alienated you are".

It would therefore appear that contemporary Western education has given rise to many of the current global environmental concerns and issues. Some of these may be caused by man's inability to realize his utter dependence on the environment and associated life-sustaining resources, others by man's inability to accept the concept of **finiteness**, i.e. "... how much the earth can take, as well as how much the earth can give" (McInnis 1975:27). From whatever perspective, either ignorance or undesirable value systems or both are at the root of all environmental concerns.

In the following paragraphs, it will be pointed out that environmental education may represent the approach needed to bring about change in current education practice, as it emphasizes classical principles and objectives of education. It is believed that through this approach a wider range of potential capabilities in pupils may be realized.

2.3 MAIN FEATURES AND OBJECTIVES OF ENVIRONMENTAL EDUCATION

The extent of current environmental problems and the possible implications for the continued existence of life on earth has resulted in a re-appraisal of the role of man

in his environment, and has resulted in new demands on the education systems of the world.

> Now, as we see more clearly the limits of the earth's capacity to meet our demands, it has become plain that our education must change ... in its recognition of the environment. On the one hand, we must recover our ancient capacity to see ourselves as part of the world, the two being interdependent; at the same time we must redirect our technological and social development towards harmony and sustainability rather than exploitation and indulgence. **This is what makes environmental education different, and it amounts to a revision of our whole educational philosophy** (emphasis added) (Smythe 1988:35).

The definition of environmental education as developed by the International Union for the Conservation of Nature and Natural Resources (I.U.C.N.) reads as follows:

> Environmental Education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture and his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulating of a code of behaviour about issues concerning environmental quality (Carson 1978:viii).

The following guidelines have been formulated by the BELGRADE CHARTER (1975), and adopted by the White Paper:

1. Environmental education should consider the environment in its totality - man-made, ecological, political, economic, technological, social, legislative, cultural and aesthetic.
2. Environmental education should be a continuous life-long process, both in school and out of school.
3. Environmental education should be interdisciplinary in its approach.
4. Environmental education should emphasize active participation in preventing and solving environmental problems.
5. Environmental education should examine major environmental issues from a world point of view, while paying due regard to regional differences.

6. Environmental education should focus on current and future situations.
7. Environmental education should examine all development and growth from an environmental perspective.
8. Environmental education should promote the value and necessity of local, national and international cooperation in the solution of environmental problems (Williams 1985:42).

Studying these objectives leaves little doubt that they can be regarded as fitting and relevant ideals for southern African schools. Environmental education could serve as a possible unifying factor and common purpose in education at a time of general political and educational reform.

A new public awareness and extensive media coverage of environmental issues together with the aforementioned White Paper on Environmental Education could place sufficient pressure on education authorities to accept responsibility for implementing these principles in formal education. This may take the form of gradual adaptations; a revolution in education is not foreseen as preference will probably be given to other urgent political changes in education systems.

It is foreseen that initially use will be made of existing expertise for in-service training and adapting curricula to implement the principles of environmental education. Some school subjects obviously present the teacher with more opportunities to expose pupils to the environment than others. Thus biology can be regarded as a unique medium for the development of not only the intellectual dimension, but also the physical, psycho-social, aesthetic and spiritual dimensions of pupils with regard to the natural environment as well as aspects of the social environment. It is therefore necessary to examine the key characteristics and objectives of biology in order to identify those aspects of the subject where adaptations should be made to realize the objectives of environmental education.

2.4 THE POTENTIAL ROLE OF BIOLOGY EDUCATION

At present we know more about environmental problems and the consequences of human mismanagement of life-supporting systems than at any time in human

history. Yet to the concerned biology teacher it appears that the body of scientific knowledge about environmental problems and issues has had relatively little effect on biology education in general other than that pupils learn of some of these environmental problems.

"An effective science education for ...pupils is imperative for the maintenance of the democratic society and of an environment suitable for life. Such a science education is vital for a new era that is already here" (Yager 1986:5).

As a life science, biology is the school subject that could serve to equip pupils with a working knowledge of the natural environment and man's role in, and his responsibility toward the environment. Since biology, as part of general science, is compulsory up to standard seven level, and since the subject has proved to be one of the most popular matriculation subjects as is reflected by the number of matriculation examination candidates, it can be regarded as being one of the primary subjects whose syllabus content and teaching methods should be reformed and adapted.

A closer look at the objectives and nature of biology as a school subject is therefore appropriate.

2.4.1 THE OBJECTIVES OF BIOLOGY EDUCATION

An analysis of the objectives of any biology syllabus leads to the realization that a number of the objectives of environmental education might be accomplished through biology education.

The objectives of the current syllabus that serves as a standard for biology syllabuses in South African schools reflect a traditional approach. According to these, the syllabus is designed to "develop in pupils the following important attributes:

1.1 an understanding of fundamental biological principles based upon a study of living organisms;
1.2 an awareness of biological relationships;
1.3 an ability to make critical, accurate observations of biological material, and to make meaningful records of such observations;

1.4 an ability to analyze and evaluate biological information, to formulate hypotheses and to suggest procedures to test them;

1.5 an ability to communicate clearly when reporting information and expressing ideas;

1.6 a respect for all living things and an urgent awareness of man's responsibilities in the preservation of life;

1.7 a love and appreciation for the southern African flora and fauna and a recognition of the urgent need for nature conservation" (Dept of Education and Culture 1986:1).

Early in 1990 this core syllabus was revised and a number of changes to content and approach were proposed in a Draft Core Syllabus (Dept of Education and Culture: 1990). These mainly included more emphasis on human physiology and a movement away from the traditional comparative approach to plant and animal studies.

However, the statement of objectives is an exact replica of that of the previous syllabus, except for the addition of "to solve problems" in 1.3. It would appear therefore that even in a new approach to this very important subject that could potentially serve to achieve a number of environmental education objectives, an ideal opportunity to bring the objectives more in line with those of environmental education has been wasted.

When these objectives are compared to what the National Assessment of Educational Progress (1978) (Yager 1986:3) has identified as desirable features for contemporary science education, the most serious shortcomings can be summarized as follows:

> Instead of emphasis on human adaptation and alternative futures, minimal consideration is given to human adaptive capacities;
>
> while biology-related social problems and issues should serve as goals, there is only marginal emphasis on society-related goals;

while decision-making involving scientific knowledge in social contexts should be stressed, the uncovering of correct answers to discipline-bound problems is stressed;

while values, ethical and moral considerations of biology-related problems and issues should be emphasized, "value-free" interpretations of discipline-bound problems are given preference.

The objectives of the syllabus will essentially be reflected in a number of aspects of the curriculum, such as materials, methodologies and evaluation practices. To affect the environmental behaviour of pupils positively, full use should be made of the natural environment, community resources and the pupils themselves as foci of study. Instead, these objectives encourage the development of a curriculum based on contrived materials, kits and classroom-bound resources. Where the objectives should demand a methodology based on information involving cognitive, affective and experiential aspects, a weak psychological basis for instruction is allowed.

Returning to the guidelines for the implementation of environmental education in formal education as discussed in par. 2.3, the following conclusion can be made:

While the objectives of any biology syllabus should, by the very nature of the subject and the urgency of current biology-related issues and problems, reflect a substantial number of these guidelines, the objectives and general aims of local biology syllabuses have to date failed to do so. Judged purely by the stated objectives, it would therefore seem that biology curricula will not make any meaningful contributions toward the achievement of the aims of environmental education.

Ost (1989:1) confirms this view when stating: "Hunger, kinship, life, society, substance abuse, applications of ethics and values, and the definition of life are but a few areas which students should be able to study through biology but because the topics do not fit neatly into the nature of traditional biology and associated curricula, the student is deprived of the opportunity".

Until such time that education decisionmakers and biology syllabus planners recognize the potential of this subject in achieving the aims of environmental education, it seems logical to produce materials that will enable teachers to develop

curricula and adopt methodologies which could at least partially fill this void. An important aspect of such an approach is to enable teachers of biology to incorporate into the process of classroom curriculum design the formulation of relevant objectives, **based on an analysis of perceived needs of pupils and the community.** These should not be limited to cognitive needs; equally important might be certain needs with regard to affective elements associated with pupil behaviour. In this way, a stronger psychological basis for biology education practice, and the selection of more relevant content and method could be achieved. The application by the teacher of such techniques could lead to improvement of teaching within the confines of the syllabus.

Furthermore, while the limitations of a logical-positivistic approach to educational evaluation are recognized, it could be possible that information generated by such a technique **applied during and after a learning experience** could likewise be valuable in evaluating content and methodologies.

In summary, it could be said that considering all the problems and limitations of biology education, and considering the strategies needed in order to address some of the problems and issues associated with the environment, it might be practical to accept that major and immediate syllabus changes are not possible. Instead, it might be a better policy to concentrate on the teaching approach, interpretation of the syllabus and the selection of curriculum objectives and content to affect improvements.

The biology teacher could play a key role in adopting an environmental approach in his classroom, initially without having to make major changes to the curriculum. He could further stimulate colleagues to adapt and develop curricula of other disciplines to teach towards a common goal, namely the development of responsible environmental behaviour.

2.5 CONCLUSION

After considering the theoretical basis of education generally, and environmental education in particular, the role that biology education could play in achieving the general goals of environmental education has been stressed. Education has been

described as **an intentional process of drawing from within certain potentialities genetically endowed to man by exposing the learner to the total environment.** This has important implications for teaching in general, as the extent to which these potentialities are realized is directly related to the **quality** of the exposure to the environment. The teacher, as **the agent between man and environment**, must therefore make sure that his intervention in exposing the learner is purposeful and effective. In these terms, the overall objective of environmental education can be stated as the **intentional exposure of the learner to the total environment in such a way as to instill those values and convey that knowledge that would ensure responsible behaviour toward the environment, and careful management of the earth's resources.**

Biology can be regarded as a "window to the living world". Studying and teaching this discipline is an important medium through which man is exposed to the living environment. Although environmental education should draw from all school subjects, thus acting as a unifying concept, biology could have a key role to play. Through biology, the pupil could get an idea of the structure and nature of science and scientific method, and become familiar with the concept of life and the conditions and systems that make life possible. This is an important function of environmental education, as solutions to all the problems and issues confronting man and his environment can only be fully comprehended - and probably solved - by applying scientific knowledge and procedures.

From the foregoing a number of aspects emerge that inspired the rationale of this research:

2.5.1 The recently published White Paper on Environmental Education may provide the necessary impetus to a movement that is currently tentative and uncoordinated. In the formal education sector in particular, environmental education has been given little prominence and has been regarded with some measure of suspicion. An examination of the principles and objectives of environmental education leads to a realization that this approach, provided that it is being assimilated into our education systems in a practical and natural way, can benefit education over a broad spectrum.

2.5.2 Curriculum content and didactic aspects of biology should be thoroughly researched and carefully reconsidered with a view to

accomplishing the objectives of environmental education. As the formation of positive attitudes toward the natural environment must be regarded as one of the key objectives of both environmental and biological education, **the development of strategies and techniques to achieve these goals through educational experiences should enjoy high priority.**

2.5.3 Stimulating teachers to teach biology that honours human nature and the character of human culture, and that recognizes the cognitive potential of human beings, is of great importance. Pre-service training should provide for the inclusion of aspects of human behaviour, particularly to values and attitudes, and the relationships that exist between the affective and cognitive domains of human experience. Various learning models should be discussed and alternatives investigated with the purpose of selecting those that will be relevant, appropriate and effective in realizing the objectives of environmental education. Attention should also be given to alternative evaluation and assessment techniques, and specifically those that will enable the teacher to gain information regarding to the affective domain of pupils.

The guidelines and principles laid down in the White Paper will result in a number of positive developments in formal education. For a number of reasons mentioned in this chapter, reform and adaptations in biology education should lead, rather than follow these developments. Major structural changes in syllabusses seem unlikely at this stage, and the teacher has a crucial role in pre-empting these changes in achieving the goals of environmental education within the confines of current syllabusses.

The development of an evaluation technique that would enable the biology teacher to collect information on various aspects of pupil attitudes toward the natural environment may provide the teacher with a means to develop curricula that include some of the important features of environmental education. It is therefore regarded as an important part of this process of development.

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CHAPTER 3

THE ROLE OF VALUES AND ATTITUDES IN ENVIRONMENTAL EDUCATION, AND SOME IMPLICATIONS FOR ASSESSMENT AND EVALUATION

3.1 INTRODUCTION

If environmental education is to help solve the problems concerning man and his relationship with the natural environment effectively, it should be based on an understanding of man, more specifically an understanding of the determinants of his behaviour toward the environment. "While environmental education is concerned with the biophysical environment and its associated problems, it ultimately is concerned with man, for you educate people, not the environment" (Swan 1974:25). It has been stressed in chapter two that **the success of environmental education depends on the formation of positive attitudes and responsible behaviour.** To effectively assimilate environmental education into formal education, the progressive adaptation of content and teaching practices includes and depends on the development of evaluation models and practices which provide for the goals of environmental education.

The significance of the relative roles of values and attitudes in the process of learning about the natural environment and behaviour toward it is stressed in literature. As these aspects feature prominently in the objectives of environmental education, it is important to delimit and define these concepts and the dynamic relationships between them, especially in an environmental context. **For the development of an evaluation instrument, which is the main purpose of this study, a clear understanding of what is meant by values and attitudes and related concepts and of their roles in the process of learning must be established.**

For this purpose, concepts such as norms, ethics, cognitions and behaviour and the mutual relationship between them are investigated. Based on these, working definitions will be formulated, and the integration of these aspects into an holistic educational model will be proposed. This will form the basis of the evaluation instrument described later.

3.2 VALUES AND RELATED CONCEPTS - RELATIONSHIPS, RELATIVE ROLES AND IMPLICATIONS FOR ENVIRONMENTAL EDUCATION AND EVALUATION

3.2.1 VALUES

Various definitions exist for values, the majority of which acknowledge their role in judgement and decisionmaking processes and ultimately in behaviour. Sterling (1985:198) defines values as referring "...to those principles, or accepted standards, of a person or group, and pertains to what that person or group perceives as worthy, desirable or correct". In his definition Johnson, (as quoted by Boyce 1980:9) covers more aspects of the concept in his definition:

> Values may be defined as a conception or standard, cultural or merely personal, by which things are compared and approved or disapproved relative to one another - held to be relatively desirable or undesirable, more meritorious or less, more, or less correct. All kinds of "things" may be evaluated: feelings, ideas, actions, qualities, objects, persons, groups, goals, means.

Rokeach (1973:5) summarises some of these ideas when stating that "...a value is an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence".

An analysis of these definitions leads to the identification of certain basic principles that explain the key importance of values in environmental education. These are summarized in the next paragraphs.

3.2.1.1 Values are human attributes

People have values; values do not inhere in objects. Values are exclusively human attributes, and are so characteristic that they are used to distinguish between humans and non-humans. Human values arise from and relate to culture, society and its institutions, and are important determinants of personality and behaviour.

One of the main functions of education, as an exclusively human action, is to expose the learner to the environment in such a manner that an appropriate and desired set of values is developed.

3.2.1.2 Values are central in judgement and choice

Values influence judgement and choice between what society generally regards as being good or bad, right or wrong, proper or improper.

"Values are placed on alternative courses of action, and we choose to do this instead of that because we value the former (or its outcome) more than the latter" (Kormondy 1985:25).

"A value system is a learned organisation of principles and rules to help one choose between alternatives, resolve conflicts and make decisions" (Rokeach 1973:14). There are however other factors that often determine a specific course of action. These are referred to as "situational factors" and discussed in more detail in par. 4.3.1

As human behaviour is characterized by continuous decisionmaking, and each human being takes decisions that influence his environment, it is inevitable that the development of desirable value systems toward the environment should be one of the most important objectives of education in general, and environmental education in particular.

3.2.1.3 The relationship of values, norms and ethics

Values and social norms are not synonymous, although a close relationship exists between the concepts. While values serve as standards for a mode of behaviour or end-state of existence, norms refer only to a mode of behaviour. Norms are also prescriptive for a specific situation, while values transcend specific situations. Furthermore, while norms are consensual and external to a person, values are personal and internal.

Despite these fundamental differences, values are closely related to norms. Values serve as points of reference for norms, and a particular norm is often determined by a number of values. At the same time "...values, as standards for establishing what should be regarded as desirable, provide the grounds for accepting or rejecting particular norms" (Rokeach 1973:19).

An ethic or moral code refers to a particular set of norms consensed by a specific society or cultural group to ensure harmonious co-existence and minimise conflict. The norms constituting an ethic are transmitted to and preserved by successive generations through the institutions of society. Religious institutions further a number of norms of a religious nature; the family, and political, economic and legal institutions specialize in other norms. In essence, these different subsets of norms share certain common values, and therefore serve to reinforce these values.

This has important implications, as an "environmental ethic" is often proposed as an overall objective for environmental education. This aspect is discussed further in par. 3.2.3.1

3.2.1.4 Values can be classified

Several classifications exist for different types of values. Boyce (1980:9) mentions "**...universal values,** referring to modes of behavior and kinds of choices related to the individual development of desirable personal qualities, e.g. honesty, truthfulness, tolerance, helpfulness and cooperation, and **particular values** related to... the scholar or academic ethic, e.g. preference for the non-material aspects of life, recognition of the good and valuable, scepticism, the full and wise use of leisure time, and respect for learning".

This corresponds to some extent to what are frequently described as **instrumental** and **terminal** values; instrumental values being those that serve as modes of behaviour which are instrumental in the attainment of all values concerning an end-state of existence. The latter can be regarded as terminal values.

A more practical classification is based on the institutions of society and the particular values that each of these maintain, enhance and transmit. This classification distinguishes between religious, economic, and also environmental values. The latter will be discussed in more detail in a separate paragraph (see par. 3.2.3.1), as the assessment of these values is of key importance in the design of an evaluation model for environmental education.

3.2.2 THE DIFFERENCES AND RELATIONSHIPS BETWEEN VALUES AND ATTITUDES

The central role that the development of appropriate value systems and positive attitudes plays in environmental education has been mentioned in chapter two. It follows that for the development of relevant evaluation models, a clear understanding of the basic differences, and at the same time the intimate relationship, between values and attitudes should be established.

There is more divergence with regard to defining attitudes than is the case with values, probably as a result of less unanimity regarding the composition and relative functions of attitudes. Rokeach defines an attitude as "... a relatively enduring organization of beliefs around an object or situation predisposing one to respond in some preferential manner" (Rokeach 1968:112). Osgood, as quoted by Reich and Adcock (1976:29) defines attitudes as "...predispositions to respond, but ... distinguished from other such states of readiness in that they predispose toward an evaluative response".

McInnis and Albrecht define an attitude as "...an enduring learned readiness or predisposition to act toward or against some thing, person or situation; there are three components to an attitude - knowledge, feeling, and the action tendency" (McInnis and Albrecht 1984:458).

These and other descriptions stress the dynamic role of attitudes in actions as responses to stimuli, and in the process of judgement and decisionmaking. In par. 3.2.1.2 however, the role of values in choosing between alternatives has been stressed. This points toward an intimate relationship between attitudes and values. However, some disagreement exists regarding this relationship. Some authors use

values and attitudes interchangeably, with values as but special cases of the attitude concept; the value concept is used informally in this sense.

However, the more popular approach is to regard attitudes as a concept distinctly different to, wider than, and inclusive of values. Rokeach (1973:18) describes this relationship and some differences between the concepts as follows:

* A value is a single belief; an attitude refers to several beliefs all focussed on a given object or situation.
* A value transcends objects and situations whereas an attitude is focused on some specified object or situation.
* A value is a standard, but an attitude is not a standard.
* A person has as many values as he has learned beliefs concerning desirable modes of conduct and end-states of existence, and as many attitudes as he has had direct or indirect encounters with specific objects and situations
* Values occupy a more central position within one's personality make-up and cognitive system than attitudes and they are therefore determinants of attitudes as well as behaviour.

Reich and Adcock (*op. cit.*:20) concede that values are less specific than attitudes, and therefore less easily detected in behavioural patterns. Also, if one holds certain values, one does not hold them a little or much, but completely; on the other hand, one can speak of degrees of **positive** or **negative** attitudes.

There is considerable agreement about the fact that attitudes consist of various elements, as this definition of Triandis (1971:2) postulates: "An attitude is **an idea** charged with **emotion** which predisposes a class of **actions** to a particular class of social situations" (emphasis added). From this it is clear that an attitude is made up of at least three distinct elements:

* A **cognitive** component, referring to that mental faculty by which knowledge is aquired or ideas formed through perception, reasoning or intuition;
* an **affective** component which is the emotion with which the idea is charged;
* a **conative** or behavioural component which can be regarded as **an action tendency.**

Although a close interrelationship between these elements has been shown to exist, the **cognitive** aspect of an attitude is more basic to the very existence of that

attitude. Triandis (1971:3) states: "The cognitive representation of the category is the minimum condition for having the attitude". However, to influence one of these elements without affecting any of the others has been proved doubtful by the research of Rosenberg (as quoted by Reich (1976)). Rokeach (1968) and Jahoda and Warren (1966)) have likewise pointed out a significant degree of consistency between these attitude elements.

It should be noted that the conative aspect of attitudes (the action-tending directiveness) is an element of the attitude and can be regarded as a product of the cognitive and affective components. However, any action undertaken towards the attitude object is considered not to be part of the attitude itself.

It can be concluded that attitudes and values are not synonymous, but that they are intimately related. "Attitudes and values are used in combination because ... it is the two in unison which constitute the strongest dispositional influence on reason in some circumstances" (Brown 1987:36). Values are important determinants of attitudes, the latter being indicative of a person's orientation or inclination toward an object or situation.

Another concept involving these aspects, and often used in describing human states of awareness of aspects of the external world, is **perceptions**. In their narrower sense, perceptions are regarded as **the act of perceiving**, and referred to as "...the apparently direct and immediate knowledge of the world, and also of our own bodies, by neural signals..." (Harre and Lamb 1983:450). In another context, perceptions of the natural environment refer to awareness of the natural world, or aspects of it and the interpretation of these by the mind. "A perception is the result of learning added to raw sensations" (Wolman 1973:273); " ...a perception is the organization of sensory data into patterns of experience" (Harriman 1959:127). These views seem to liken perceptions to beliefs, confident opinions, or dispositional influences. Thus perceptions can be described as "...including such activities as observing, recognizing, discriminating and grasping meaning" (Goldenson 1970:936), and as involving more than sensory and cognitive faculties.

3.2.3 VALUES AND ATTITUDES IN AN ENVIRONMENTAL PERSPECTIVE

Much of what has been researched and written about values, ethics, attitudes and related concepts has social implications, referring to man in society. There has been comparatively little research on the application of these concepts to man's relationship with his natural environment, and yet the current unsatisfactory state of this relationship is often ascribed to the values man holds toward the environment.

In this regard Swan (1974:34) states : "There seems to be almost unanimous agreement among environmentalists that part (if not all) of our environmental problems stem from our current social values". Many blame attitudes such as excessive materialism, individualism and nationalism as the fundamental causes of the environmental crisis.

It must be conceded however that ignorance about those concepts related to the maintenance of harmony and balance in nature also played a significant part in creating the current environmental conditions that have led Sterling (1985:197) to state: "...unless a determined effort is made very soon, the situation could come to a point of involving a threat to the very survival of the human species".

It is therefore appropriate to relate the principles discussed in the foregoing paragraphs to human behaviour with regard to the environment, and more particularly the natural environment.

3.2.3.1 Environmental values and environmental ethic

In a previous paragraph social ethics were discussed, and the appropriateness of an environmental ethic as a possible educational ideal proposed. The significance and relevance of such an environmental ethic are currently being accentuated in the search for solutions to the present environmental problems. The "land ethic" proposed by Leopold in 1949 stated simply: "A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends to do otherwise" (Swan 1974:34).

This concept has been elaborated upon more recently by various authors. Doran (1977:51) quotes Brandwein in stating that "...conservation is an ethic - it is a value", and also Abram and Rosinger: "...human attitudes and values are at the heart of this new conservation". Willard (1976:9) describes the main principles or standards characterizing such a "new ethic" as "...an ever deepening sense of kinship with and reverence for life".

Emmelin (1984:16) regards the following as organizing concepts "...that must pervade such an ethic:

* understanding the interdependence of living things and ecological systems;
* respect for nature;
* the principle of holism in treating environmental matters;
* a regard for the needs of future generations;
* an understanding of the close ties between the safeguarding of the environment and development".

The question may be raised whether the values supporting such an environmental ethic are "specific" to the value object, i.e. the environment, or whether these values are related or even synonymous to general values. Researching this issue, Baker, Doran and Sarnowski (1978:36) used the six value types described by Spranger (1928) in an effort to determine the relationship between "environmental values" and "general values". These value types are:

* Theoretical - interest in the discovery of the truth;
* Economic - interest in the useful;
* Aesthetic - interest in form and harmony;
* Social - interest in human relations;
* Political - interest in power;
* Religious - interest in the comprehension of unity with the cosmos.

The researchers' null hypothesis, stated as: "There is no relationship between general values and environmental values" could not be supported. It was found that the value systems held with regard to the environment and environmental issues corresponded with the general values held by the majority of the respondents.

In summary it can therefore be stated that **the same values and standards that serve as reference points for social norms support those norms that constitute an ethic to guide human behaviour towards the natural environment.**

It must be stressed however that an "environmental ethic" can and should not be regarded as a separate ethic. Such an ethic is often based on a love for nature, concern for the continued existence of (human) life, the "rights" of other forms of life, the "stewardship" tradition or self-interest. An environmental ethic should be regarded as a character of a common practical ethic or morality based on a concern for the quality of life of all people.

The implications of this for environmental education are significant. Those values to be developed with reference to the natural environment, are not specific to the environment but values such as responsibility, concern, wonderment, reverence for life, honesty, unselfishness and some others that will be elaborated upon at a later stage. Collectively, these values support an ethic or morality that should serve as the overall objective of environmental education.

3.3 SYNOPSIS: DEFINITIONS OF KEY CONCEPTS

The development of an evaluation instrument for assessment and evaluation purposes in environmental education relies on a clear comprehension of the key concepts discussed in the preceding section. In the next paragraphs, a series of working definitions for these concepts will be formulated.

A **value** is a standard by which alternative courses of action are judged. These standards are related to culture and society; one can discern between religious, political, economic, aesthetic and social values. **Environmental values** are "general values" when interpreted from the perspective of the natural environment. These values are the underpinning of an **ethic** or morality that should serve as action-tending directive, governing man's choice of action to be reconcilable with the ecological principles governing the natural environment, as well as with the general well-being of all people.

Value systems is a term often encountered in literature. "In some circumstances values may be organized into systems, all related to matters of broad community concern such as the protection of the environment" (Brown 1987:36). In this thesis, a value system refers to that set of values which predisposes a positive and desirable attitude towards the natural environment and conservation.

An **attitude** is a state of mind or orientation toward an object, concept or person. An attitude is defined in terms of a **cognitive component** (ideas), an **affective component** (emotions, feelings or values) and a **conative or motivational component**. Attitudes are facilitative, but not essential causes of behaviour.

Cognitions are the results of learning facts, principles and concepts. Cognitions are essential components of certain attitudes and the minimum conditions for having these. **Environmental cognitions** can be described as a body of basic knowledge of key concepts regarding the natural environment, especially ecological concepts and those concerning the human impact on the natural environment.

Perceptions are states of awareness of aspects of the external world through physical sensations and the interpretation of these. A perception can be regarded as a function of the cognitions of a certain aspect and the values held with regard to this aspect. An **environmental perception** is described as "...consciousness, understanding, and awareness of elements, interrelationships, and problems of the environment through sensory knowledge and judgment" (Gilpin 1979:13).

3.4 IMPORTANT IMPLICATIONS FOR ENVIRONMENTAL EDUCATION AND EVALUATION

In environmental education the formation of positive attitudes toward the natural environment and conservation has been singled out as being of key importance.

Taking into account what has been discussed regarding the properties and composition of attitudes (par. 3.2.2) it can be inferred that certain attitudes may be held specific to the natural environment. Consequently, these attitudes are based on the following aspects:

- a desired positive value system;

- basic environmental cognitions;
- a conative aspect, or the tendency to act with regard to the environment and conservation.

The concept of values and cognitions in an environmental context has been discussed in earlier paragraphs. The intimate relationship that exists between values and cognitions in the make-up of an attitude has important implications for environmental education practice in general, and evaluation procedures in particular. The most important of these implications is that **attitudes can be positively influenced by education through influencing cognitions and values.**

It is however accepted that certain attitudes, particularly those arising from upbringing and cultural influences, are not readily susceptible to change as a result of education. These attitudes are termed **personal attitudes** by Byrne and Johnstone (1988:251). There are however those attitudes that are much more susceptible to change, termed **cognitive attitudes**, in which changes are more readily brought about by the presentation of new evidence. Attitudes toward the natural environment and conservation mainly fall within the latter category.

In teaching for a positive change in environmental attitudes a **holistic** approach is generally advocated, based on the belief that the whole is more than the sum of the parts. Applied to environmental education this means that instead of emphasizing the facts of ecology, the natural environment and conservation, the teacher who wishes his students to become conservation orientated and environmentally literate should positively influence the value systems, and thus the attitudes of pupils while facilitating the learning process about the environment.

It follows that "value-free" science education, if at all possible, may not succeed in creating in pupils more than a superficial awareness of aspects of the natural environment. The so-called "scientific world-view" likewise seems counterproductive as a basis for environmental education (Sterling 1985:200). This approach elevates science and fact and the ability to master these in learning processes to positions of superiority over some other human attributes and abilities.

This approach has also taken hold in education, and while relatively little attention is being given to the development of **general (social) values**, the issue of values and

attitudes regarding the application of scientific knowledge to decisionmaking processes about the environment and life in general is being seriously neglected. In terms of values or moral education in general Harshman (1979:30) quotes several authors who worked toward the development of this approach in schools. He states that ..."they have been concerned with the values and morality of social interaction and policy decisions, and have been primarily anthropocentric in their focus. Human values and interpretations of reality have received primary concern, and little regard has been given to the values and realities of the natural ecosystem. Therefore, little impact from their work is found in environmental literature. However, **environmental educators should be aware of values or moral education theory and processes and the applications that can be made to environmental education**" (emphasis added). This may have the potential of contributing toward a new general awareness among pupils of the need for conservation and the responsible use of resources, and ensuring quality of life for all.

Opie (1989:3) contrasts the features of an "old awareness" with those of a "new awareness" as follows:

- **No spiritual dimension admitted** vs **Revival of a sense of the sacred.**
- **Understanding is in the mind alone** vs **Life is to be experienced fully.**
- **Facts are independent of feelings and values** vs **Facts are understood in terms of feelings and values.**

The foregoing has significant implications not only for environmental educators, but also for evaluation practice. It is clear that in order to influence pupils' attitudes toward the natural environment, the teacher should facilitate the development not only of cognitive gain, but also a value system that includes the following:

* reverence for life:
* empathy and compassion;
* a sense of awe and wonderment;
* concern for the needs of others;
* an appreciation of the aesthetic;
* responsibility;
* acceptance of the role of humans as trustees in creation;
* non-exploitiveness;
* non-manipulativeness; and
* acknowledgement of error.

While it is not the purpose of this thesis to expand on the area of environmental values education, it may be useful to propose a model for environmental education, incorporating the principles discussed in the foregoing paragraphs. This model (fig. 3.1, p. 42) should reflect essential elements of a constructivist paradigm for both learning and teaching. Teaching within this paradigm is described as "... a shift from someone who teaches to someone who tries to facilitate learning" (Bodner 1986:875). Learning is represented by processes of assimilation and accommodation whereby knowledge is constructed in the mind of the learner on the basis of pre-existing structures. The following could serve as guidelines for such a model:

1. As the ultimate goal of any environmental education experience is a positive change in behaviour toward the environment, the objectives should be formulated unequivocally in terms of cognitive and affective aspects associated with behaviour. The environmental educator should be aware that he is **teaching for a change in attitude**, thereby positively influencing pupil behaviour. The *sine qua non* of such teaching is the holistic approach based on the belief that cognitive and affective development cannot be separated in individual or group learning.

2. Environmental education requires that the teacher enrich his teaching by applying those teaching strategies that ensure **maximum exposure of pupils to real world situations**. Instead of giving information, the teacher acts as an agent between learner and environment. Discovery, hands-on experiences in the outdoors, the gathering of data, practice in decisionmaking, testing hypotheses and excitement experienced in a climate that will further both cognitive and affective development are important elements of environmental education.

3. The importance of **knowledge** as a precondition for the development of environmental attitudes is acknowledged. Cognitive learning alone however is not enough in affecting values and attitudes, and ultimately, behaviour. "Research shows little correlation between cognitive achievement and concern and values" (Caduto 1983:14).

Changes in environmental attitudes are brought about most effectively by increasing the level of knowledge of the learner while involving him emotionally and addressing experience in the area (Borden and Schettino 1979:37). It is important therefore that the environmental educator involve all aspects of learning - cognitive, affective and conative. This is essential for the development of environmental literacy or **ecolacy**, a term described as "...the level at which a person achieves a working understanding of the complexity of the world" (Hanks 1987:2).

The interaction between the cognitive and affective domains, and existing cognitive structures in the learning process is recognised. The nature of this relationship is partially explained by Eiss (as quoted by Doran 1977:52) when he states that "...the affective area acts as a **screening device filtering the vast morass of sensory information, and processing only some input into the learning model.** Behaviour, in turn, influences what sensory information impinges on the affective screen or filter mentioned earlier" (emphasis added).

Confluent teaching of values and cognitions in a holistic approach is therefore essential, as the formation of a positive values system has an important influence not only on attitudes, but also on the extent to which new sensory information permeates the "affective screen" in order to have any positive influence on the learning process.

4. Favourable perceptions about the natural environment depend on the effectiveness of this learning process (see par 3.2.2), and are instrumental in bringing about a tendency to act. Collectively, these aspects represent the key components of a positive attitude or desired orientation toward the natural environment.

5. Attitudes are only one of a number of factors influencing the overt behaviour of an individual. Examples of other factors, termed **situational factors** (Hines *et al.*, 1987:7) are personal needs, socio-economic circumstances, habits, reward or punishment and cultural,

religious and family background. These are not normally readily influenced by education.

Although the attitude factor should therefore not be regarded as the only, or even the most important determinant of behaviour, it should be regarded as of great importance, as this is one factor that education could influence succesfully. For this reason it deserves prominence in any environmental education strategy, and likewise in evaluation approaches.

6. Attitudes not only influence behaviour, but together with behaviour have an important influence on the learning process itself. **A positive attitude toward the natural environment and its conservation result in a willingness to learn, and therefore facilitates learning about it.** This explains the cyclical nature of the model.

These guidelines are represented graphically in the flow diagram shown in Figure 3.1.

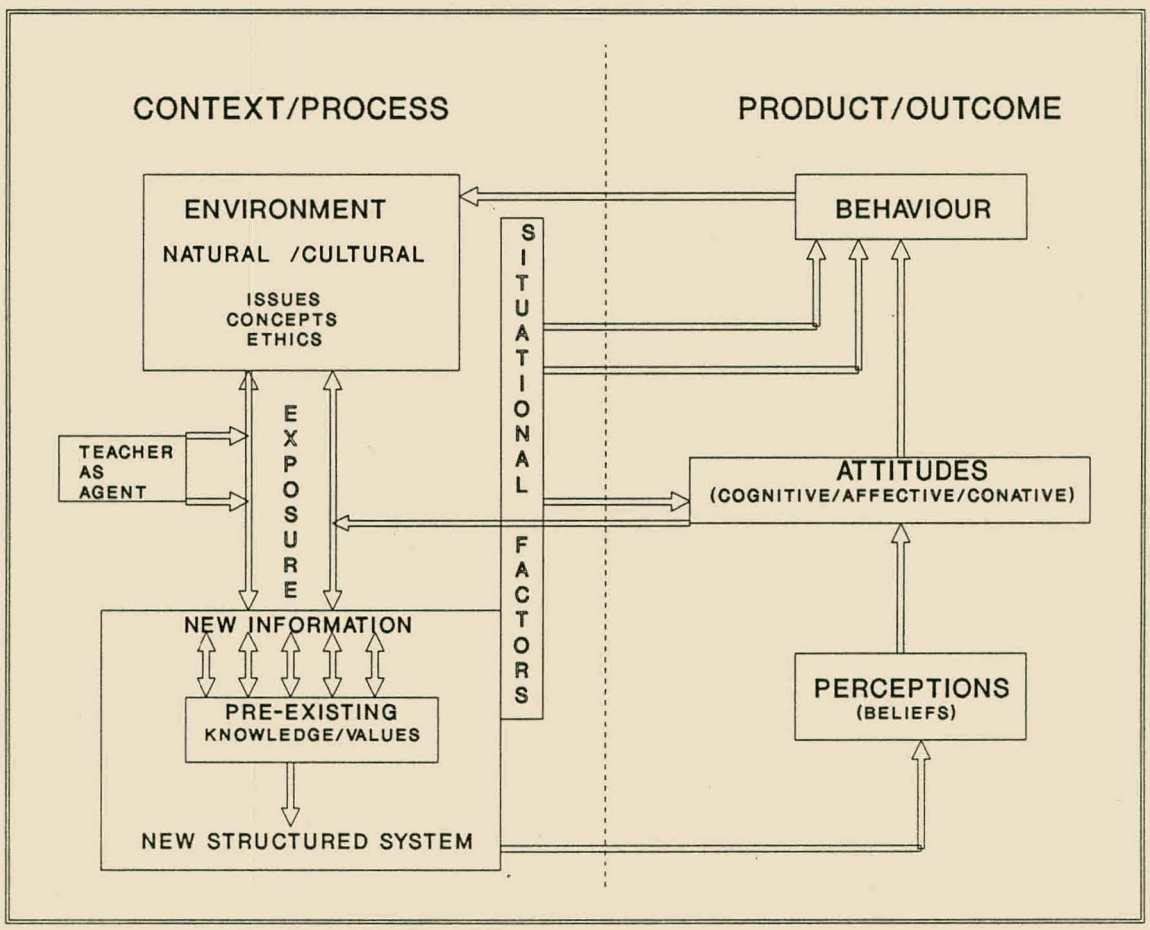

Figure 3.1

Diagram of a Proposed Model for Environmental Education.

It is clear that in order to obtain relevant data on pupils' environmental attitudes, assessment and evaluation techniques should concentrate on the different aspects associated with attitudes and behaviour.

Much as "value-free" education seems to be a contradiction in terms, the same may be said of evaluation techniques in environmental education. Evaluation programmes that ignore the key importance of affective and conative aspects may produce insufficient and inappropriate data.

3.5 CONCLUSION

In this chapter, an attempt has been made to clarify some of the concepts related to the affective domain, since the key objectives of environmental education include the development of value systems and positive attitudes with regard to the environment.

The concept of values was examined on the basis of various descriptions and definitions as well as its relationship with aspects frequently used in the formulation of objectives for environmental education, such as attitudes, morals and ethics, and behaviour. These terms were looked at from the perspective of man's relationship with the natural environment, and working definitions were formulated with the aim of incorporating the key concepts into a functional model for environmental education and evaluation.

While the different aspects of attitudes are not to be separated into entities to be assessed when attempting to evaluate the outcome of environmental education, some of these were regarded as important aspects of environmental behaviour which should be the focus of evaluation. These aspects are cognitions, values and conative elements. The measurability of these aspects is however highly contentious, and will be discussed in the next chapter.

The definitions, inferences and models proposed in this chapter will serve as the basis for the development of an evaluation model and the associated instrument which is the subject of the ensuing chapters.

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CHAPTER 4

THEORETICAL PERSPECTIVES ON EVALUATION, WITH SPECIAL REFERENCE TO THE DEMANDS OF ENVIRONMENTAL EDUCATION IN CLASSROOM PRACTICE.

> "The major ingredient necessary to evaluate environmental education is just good common sense ...although the process is still complex and the implementation difficult. The importance of environmental education, however, demands that we all attempt ... to improve it through evaluation..."
> - Joseph F. Passineau (1984)

4.1 INTRODUCTION

Environmental education has reached the stage where the development of relevant programmes for formal education should enjoy high priority. Crucial elements of the development of such curricula - on both macro- and micro- levels - are the collection and interpretation of information, as it is on a body of relevant information that selection of course objectives, content and methodologies should be based.

"Evaluation, as applied to education, is the process of collecting and using information pertinent to making decisions about a program" (Cronbach 1963, as quoted by Passineau).

Essentially, this information should include aspects such as existing cognitive patterns and attitudes and aspects of behaviour in regard to the environment as these are key elements of the goals of environmental education. Further, this body of information would probably not be complete without some form of feedback on the outcome of early, more tentative programmes.

It seems self-evident that instruments should be developed which could serve this purpose, a view confirmed by various authors (Larkins and Shaver 1972; Bennett 1974; Wheatley 1984).

However, it is exactly this area, namely the evaluation of aspects such as attitudes and behaviour, that is highly problematical and controversial, and most developments in this field are viewed with some skepticism. In developing an instrument for this purpose, full cognizance is given to this fact, but the problems should not distract from the importance of such a development.

4.2 THEORETICAL FRAMEWORK FOR EVALUATION IN ENVIRONMENTAL EDUCATION

In this section, a number of key issues in the construction of a theoretical framework for evaluation in environmental education will be dealt with.

4.2.1 WHY DOES ENVIRONMENTAL EDUCATION DEMAND A DIFFERENT APPROACH TO EVALUATION?

Current educational evaluation practice is based in part on classical Tylerian principles in as much **as it is based on an assessment of how well educational objectives have been attained by pupils.** Owing to the higher degree of measurability of cognitive objectives, assessment concentrates almost exclusively on these. However, in his original description of objectives-based evaluation Tyler implied much more than cognitive and skills objectives; according to the Tylerian Evaluation Rationale, **objectives have to be stated in terms of behavioural outcome** (Tyler 1942, as quoted by Stufflebeam 1983:119).

The main goals of environmental education have been analyzed in the preceding chapters. It is clear that these include more than cognitive objectives. Hence evaluation may enable the evaluator to collect information about a wider range of aspects associated with pupil behaviour toward the environment.

4.2.2 WHAT ARE THE MAIN PITFALLS IN THIS AREA, AND HOW SHOULD THEY BE APPROACHED?

The main problem areas are twofold:

- Firstly, there is the danger of a logical-positivistic assumption that any desirable outcome of education is directly measurable.
- Secondly, there are widely acknowledged difficulties in the area of assessment of behavioural and attitudinal outcomes of education.

Both these problems should be approached circumspectly, and prospective users of the technique should be made aware of them. Perhaps an approach where responses are merely categorized instead of weighted (judged) might in part satisfy the need to collect information without the need to measure.

4.2.3 WHAT FUNCTION SHOULD EVALUATION ACHIEVE AND WHEN SHOULD EVALUATION TAKE PLACE?

"... the main purpose of evaluation is not to prove, but to improve" (Stufflebeam 1983:118). It has been mentioned earlier that the ultimate function of evaluation should be seen within the broader paradigm of curriculum improvement and development. To achieve this, it would seem necessary to evaluate throughout the development and implementation of a curriculum, starting even before any educational programme is designed. The schematic representation (fig.4.1) adapted from Passineau (*op. cit.*: 376) of the function and place of evaluation in environmental education illustrates this view.

This model illustrates the broader paradigm suggested to suit the needs of environmental education. Evaluation, in the form of continuous collection of information at various steps of the curriculum, is a continuous and refined mechanism to ensure that the information resulting from each step is cycled back to where changes can be made.

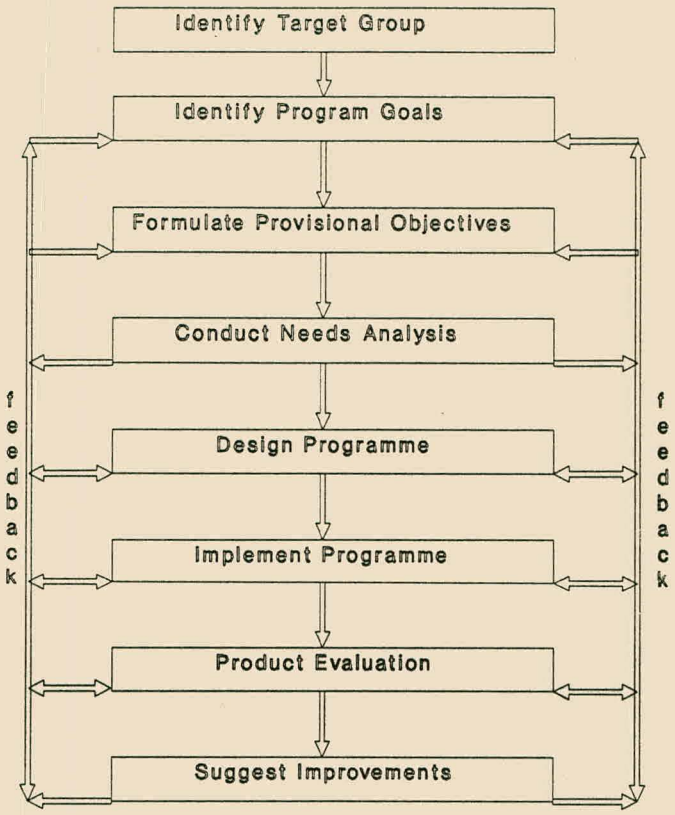

Figure 4.1

Model of Evaluation in Environmental Education, adapted from Passineau (1984:376)

In contrast to the long-established practice of using only the results of curriculum outcome assessment as feedback, all the steps in this model depend on the feedback supplied by continuous evaluation.

This approach is accepted by many educational researchers. In their description of **illuminative evaluation**, Parlett and Hamilton mention two important aspects: evaluation of the instructional system, and the learning milieu. Both these depend on the collection of relevant information.

Stake (1983:304) likewise stresses the importance of this broader paradigm in suggesting methods that he has termed "antecedent conditions evaluation", and "transaction evaluation", with the former in particular including elements of needs analyses. This aspect is also emphasized by Eisner (1985, as quoted by Human 1986:16) when he states:

> If the experiential background of students is so remote from the content encountered as to make it essentially meaningless, it is obvious that the curriculum, regardless of how defensible on other grounds, is inappropriate for that population.

The "CIPP Model for Program Evaluation" described by Stufflebeam (1983) is particularly relevant. This model confirms the need for the development of additional evaluation instruments to assist in the development of environmental education curricula. One of the chief motives for the development of this model was the difficulty of formulating curriculum objectives for a specific product evaluation excercise as "...the needs of the students were highly variable and had not been the subject of serious study, and ...no common set of objectives could have been responsive to their varied developmental levels and needs" (Stufflebeam, *op. cit.*: 121).

The development of evaluation instruments to collect information on pupil attitudes and behaviour toward the natural environment might assist the teacher in the process of **context evaluation** designed to address the following questions (Stufflebeam, *op. cit.*: 124): "What needs are addressed, how pervasive and important are they, and to what extent are the project's objectives reflective of assessed needs"?

Information thus generated will naturally lead the teacher to the next phase of curriculum evaluation, i.e **input evaluation.** During this phase, the possible procedures for implementing a curriculum are evaluated. This would entail an evaluation of materials and approaches, and the different school subjects that can contribute toward the attainment of curriculum objectives (compare fig. 4.1).

Process evaluation is an ongoing process where the extent to which the programme is implemented is evaluated, and decisions taken on how and why it should be modified. This is also a vital source of information for interpreting product evaluation results.

Product evaluation is the next logical step in the programme, and is represented by an assessment of how well the curriculum objectives were achieved, and to what extent the needs of the target population were being met. This process can take place both during and at the conclusion of a programme cycle. It should also be extended to assess long-term effects.

The main goal of this study is to develop an evaluation technique that may meet some of the demands of this broader approach to evaluation in that it could be applied in a formative sense, i.e. in both context and product evaluation in order to inform decisions on curriculum objectives, content, materials and methodologies.

4.2.4 WHO SHOULD EVALUATE?

For mostly practical reasons, it is foreseen that curriculum development at micro-level, i.e. in the classroom, will determine the success of environmental education in formal education. However, teachers may probably not be supplied with either "customized" curricula or suitable material but might at most be encouraged to use whatever opportunities their subject offers to implement the principles of environmental education.

Nevertheless, in very few subject areas is the social context in which learning and teaching is to take place as decisive as in environmental education. It follows logically that the teacher himself should be involved in utilizing all the sources of collecting information to "...provide a rich array of background data against which to interpret and understand outcomes" (Stufflebeam, *op. cit.*: 128)

One of the important principles that serves as guideline for this study is that the proposed instrument should be user-friendly. If the teacher himself has no access to the tools necessary for collecting information, there may be little or no contribution toward curriculum development and improved teaching. Also, if a teacher can measure a certain aspect, it is more likely that he will teach it; or as Jones and Bray (1986:13) put it: "Aims not reflected in assessment procedures do not receive the same status as those which are".

4.2.5 WHAT ASPECTS SHOULD BE THE FOCUS OF EVALUATION, AND HOW CAN THEY BE IMPLEMENTED?

It has been suggested that an important target area for evaluation or collecting information is that of aspects of attitudes and behaviour. This is a particularly troublesome area, especially if pencil and paper tests are used. Nevertheless, a variety of approaches and instruments in this field is described in literature.

In the next paragraphs, the views of some researchers on what should be evaluated and how it could be approached are discussed.

4.2.5.1 The evaluation of environmental behaviour

Efforts at evaluating pupil behaviour toward the environment can be classified into two main trends: the. evaluation of overt behaviour and the evaluation of attitudinal aspects associated with behaviour. Examples of both are discussed briefly.

(i) Overt behaviour as a measurable variable

An example of this type of evaluation has been described by Asch and Shore (1975:25-33). This study concentrates on behavioural patterns in evaluating certain environmental education programmes. Pupils were subjected to an intensive educational experience in a nature reserve after which aspects of their behaviour regarding several conservation issues were discreetly observed and assessed. A control group was used to compare behaviour patterns, and significant differences were described.

Bennett (1974:145) has described a similar evaluation model in which certain procedures were followed to observe unobtrusively the overt "conservation behavior" of a group of pupils under experimental conditions. Although this aspect was part of a comprehensive evaluation project to assess the outcome of an environmental education experience, the behaviour observed was in regard to littering, and therefore limited in scope and applicability. It seems doubtful that this

strategy would be functional where long-term goals of an environmental education experience such as the conservation of indigenous plants and/or animals, the responsible use of energy resources and the conservation of soil are described in behavioural terms.

In both these studies, the results were used to make inferences about the pupils' attitudes towards the environment. This would appear to be in conflict with the view that attitudes are only one of a number of determinants of behaviour and that situational factors are at least equally important.

In theory, observing overt behaviour toward some aspects might yield more dependable results than the alternative use of self-reported behaviour (verbal statements of behaviour). This has been confirmed by research undertaken by Hines, Hungerford and Tomera (1987:2).

From a practical point of view, however, there are several objections to be raised against observing behaviour as a variable for evaluation or assessment.

Firstly it seems impossible to control factors like habits, upbringing, socio-economic background and peer-group pressure which influence the behaviour pattern of a group or individual.

Secondly, it would be difficult to determine exactly which area(s) should be addressed in order to remedy any "abnormalities" identified in a specific behaviour pattern. Although this technique might yield interesting results in categorizing people or perhaps even in objectively assessing the short-term effectiveness of certain programmes, it appears less effective in providing feedback for redesigning or adapting a certain programme.

Thirdly, it is impractical in terms of time and manpower to keep a group of pupils under such close and unobtrusive observation for any period of time.

As a result of the difficulties encountered in the evaluation of overt environmental or conservation behaviour, more effort has gone into studies where attitudinal elements associated with behaviour have been investigated. Some which were

regarded as having particular relevance to this project are described briefly in the subsequent paragraphs.

(ii) Evaluation of attitudinal elements associated with behaviour

"Environmental educators are increasingly aware of the important role of attitudes and values in determining the action of an individual toward the environment. Consequently, instruments which can measure these attitudes and values are in demand" (Wheatly *op. cit.*:408). Hines, Hungerford and Tomera (*op. cit.*:4) confirm this in stating that there appears to be an "... existence of a positive relationship between attitude and behaviour, in that those individuals with more positive attitudes were more likely to have reported engaging in responsible environmental behaviour than were individuals with less positive attitudes".

Techniques from the field of psychology have therefore been adopted for the evaluation of aspects of pupil attitudes toward aspects of conservation and the environment.

The attitudinal determinants of environmental behaviour offer a number of possibilities regarding aspects to be evaluated. Hines *et al.* (*op. cit.*:2) stress the importance of further applied research in this field when they state: "... while a tremendous variety of variables has been investigated in relation to behaviour in an environmental context, there is at present no agreement among researchers as to which of these variables appear to be most strongly associated with responsible environmental behaviour. Such information is vital to environmental educators for its potential in terms of providing a sound empirical base on which to construct appropriate curricula for the development of environmentally responsible and active individuals".

These authors' contribution was the analysis of 128 evaluation research projects based on the variables associated with responsible environmental behaviour. The purpose of this exercise was to determine the relative strengths of the relationships between each of these variables and environmental behaviour. Based on these findings, they proposed the model of responsible environmental behaviour, represented in fig 4.2.

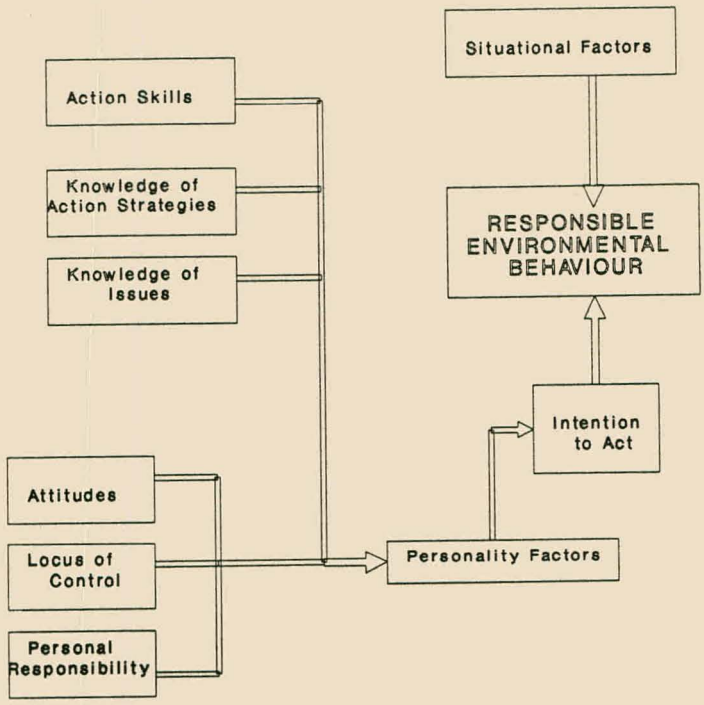

Figure 4.2

Proposed Model of Responsible Environmental Behaviour (from Hines et al. 1987:7)

This model acknowledges the fact that certain other uncontrollable variables have important influences on behaviour:

> One remaining category exists which can interrupt this pathway to action - these are situational factors. Situational factors, such as economic constraints, social pressures, and opportunities to choose different actions, may enter the picture and serve to either counteract or to strengthen the variables in the model (Hines *et al.*: *op. cit.*:7).

It seems that an evaluation instrument for classroom use based on this model would present a problem, as there are simply too many variables to consider. This factor seems to further compound the difficulties in selecting a course of action for the development of a simple instrument, and it might therefore be necessary to consolidate and regroup some of the variables of the model. To achieve this, some

basic assumptions will have to be made in order to start any development in this field. One of these is the assumption that there exist at least three elements in the make-up of any given attitude (see par 3.2.2, p.32), and that each of these can be evaluated.

Triandis (1971:3) has suggested a useful model to illustrate some approaches to the assessment of these three generally accepted attitudinal elements. This is represented in fig. 4.3.

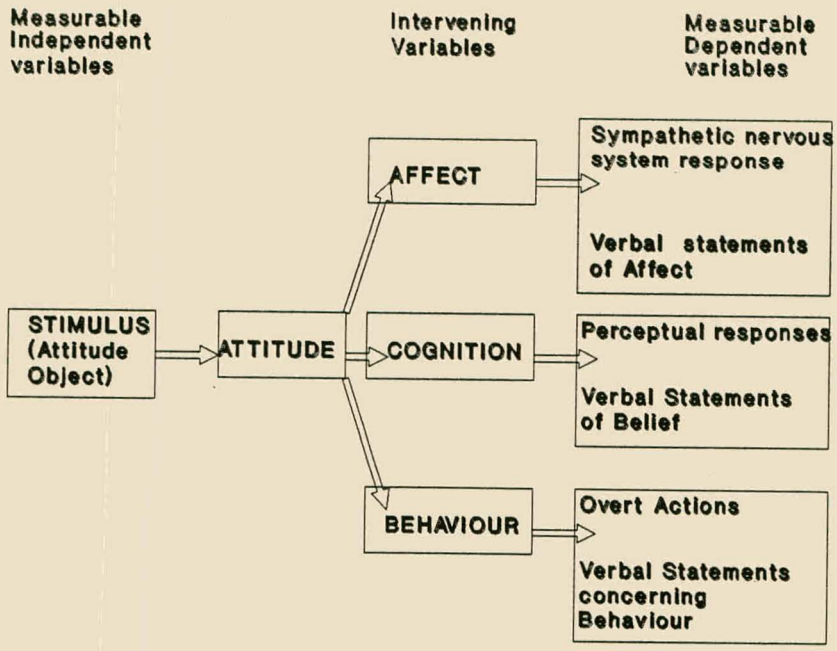

Figure 4.3

A Schematic Representation of Measurable Aspects of Attitudes (Triandis 1971, after Rosenberg and Hovland 1960)

In the blocks on the right hand Triandis suggests the different techniques for evaluating the respective variables. It would be completely impractical to consider such strategies as "sympathetic nervous responses", "perceptual responses" and

"overt actions", especially in a classroom situation. Furthermore, if these variables were treated as separate entities in the process of assessment, this might be based on the illogical assumption that three different domains exist.

Using verbal statements of affect, belief and behaviour respectively may partially overcome both these difficulties. Such an approach to evaluation of attitudes does not necessarily imply acceptance of three separate domains, but rather that there are three aspects which represent the minimum evaluable variables associated with attitudes. Further reference to the aspects cognitions, affect and action tendencies in this study should be seen against this background.

Having identified the minimum number of "measurable variables", the next step would be the development of an instrument to assess these. This presents further difficulties, as the composition of such an instrument is determined by the following minimum demands:

* It should be applicable in the paradigm for evaluation suggested earlier in this chapter.

* It should take cognizance of the controversies surrounding the evaluation of affective aspects in particular.

* It should be accessible to the teacher as the researcher and developer of a curriculum, to serve as additional evaluation strategy in order to improve teaching.

A number of approaches based on these variables were studied. The approaches were designed either with the view to evaluate the effectiveness of environmental education programmes based on outcome, or to assess attitudes with the purpose of categorizing people in order to maximize the effectiveness of education programmes. Some of the evaluation approaches regarded as relevant to this project are discussed briefly.

In 1975, Wheatly studied seven such evaluative approaches for application to environmental education situations that were based on the affective domain of learning (Wheatly *op. cit.*:408-413). Most of these lack applicability for this

development owing to either the structured nature of the response items, the high reading level required, oversimplification, limited scope or complex statistical analysis required for the interpretation of the results.

Some attitude assessment studies examined in a literature search concentrated on either "state-of-the-art" evaluation, or efforts to typify and compare attitudes of certain groups under different conditions (Henerson, Morris and Fitz-Gibbon 1978; Horvat and Voelker 1976; Bihari 1984; Kellert 1980, 1984, 1987). Some of these approaches, especially those of Kellert, may be of value in that by studying the attitudes of a certain group of people, some idea may be formed of the most effective teaching strategy to follow in a given context.

The majority of the approaches studied made use of pencil-and-paper tests or questionnaires, consisting of attitudinal statements linked to either Likert-, Thurstone- or semantic differential-type structured-response items. All were found to rely on complex statistical analyses.

Two main approaches within this cadre are evident, namely those that **identify attitudes according to a predefined classification system and those that assess and evaluate attitudinal components.** In terms of the proposed learning model discussed in chapter three (see figure 3.1), and the theoretical framework suggested in chapter four, the latter type of evaluation design was found to be more applicable. Applied to curriculum evaluation, it could enable the teacher to investigate aspects of pupil attitudes with the view of developing a suitable curriculum, or even serve a useful purpose in product evaluation.

Used in combination with a model that illustrates tendencies with regard to student orientations (or attitudes) toward the environment graphically may enhance the utility of the evaluation technique based on these variables of pupil attitudes. This is especially true if such representations of context and product evaluation results for a specific group are compared to illustrate change.

A model with the potential to meet these requirements is discussed in the next paragraph.

4.2.6 ADAIR'S FOUR DIMENSIONAL MODEL FOR ORIENTATION CATEGORIES

An evaluation model where **different aspects of attitudes such as cognitions, values and action tendencies** are assessed in order to identify distinct orientation categories regarding the **social behaviour** of people was first described by Adair, as quoted by La Hart and Tillis (1974:44). His description of these categories typifying human social behaviour is summarised in figure 4.4 below:

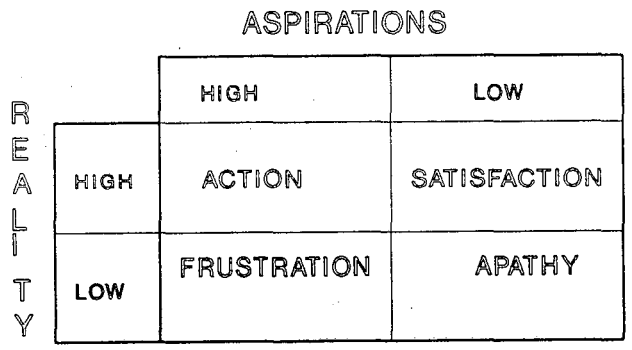

Figure 4.4

Adair's Four Orientation Categories of Human Behaviour (Adapted from LaHart & Tillis 1974:45)

According to Adair's description, the combination **of human aspirations** and **reality** represent the driving force behind human behaviour.

People with high aspirations and a set of real conditions suggesting success are prone to act and are classified in the ACTION category. Conversely, people with low aspirations and a perceived inadequate set of conditions will most probably be inactive and characterized by APATHY. A person possessing low aspirations, but organized sufficiently to meet felt needs, would be categorized in the SATISFACTION category. On the other hand, high aspirations combined with a disorganized set of circumstances characterized by repeated success denial would give rise to FRUSTRATION.

Various researchers have attempted to relate these orientation categories to the natural environment, wildlife or conservation in general.

LaHart and Tillis (1974) applied this model to the orientation of people toward **endangered species of wildlife.** The description of the categories were adapted to apply in this new context as follows:

APATHY	Lack of feeling about the world around him; indifference; no emotional involvement. "So what's next?" attitude.
SATISFACTION	Complacent; aware, but not involved. "The situation is O.K. by me." "I won't do anything about that."
FRUSTRATION	Not satisfied with the situation, but helpless to do anything about it. Repeated goal denials. "I've tried that, but it didn't work."
ACTION	Studies and learns about the problems and works to solve them. Has a feeling for man-earth relationships and acts by his conscience. "I can do it."

The authors hypothesized that educational experiences move people from satisfaction, frustration and apathy toward action (LaHart and Tillis *op. cit.*:46).

This model was further developed by Adams, Newgard and Thomas (1986) in order to identify these orientation categories toward wildlife in students . For this purpose the theory proposed by Triandis (*op. cit.*:3) was accepted that these orientations are multidimensional and determined by **three model components:**

1) Attitudes (affective aspects);
2) Perceptions (cognitive aspects); and
3) Involvement (behavioural aspects).

In applying the model, a group of pupils were assessed in regard to each of these components, scored along a high-low continuum for each. A respondent could

therefore score either high (above a pre-determined mean point) or low (below the mean point) for each model component. The eight possible score combinations were then interpreted in terms of Adair's four dimensions of human behaviour.

The schematic representation below gives an idea of how these eight possible combinations of model component scores are regrouped to coincide with Adair's four dimensions of human behaviour.

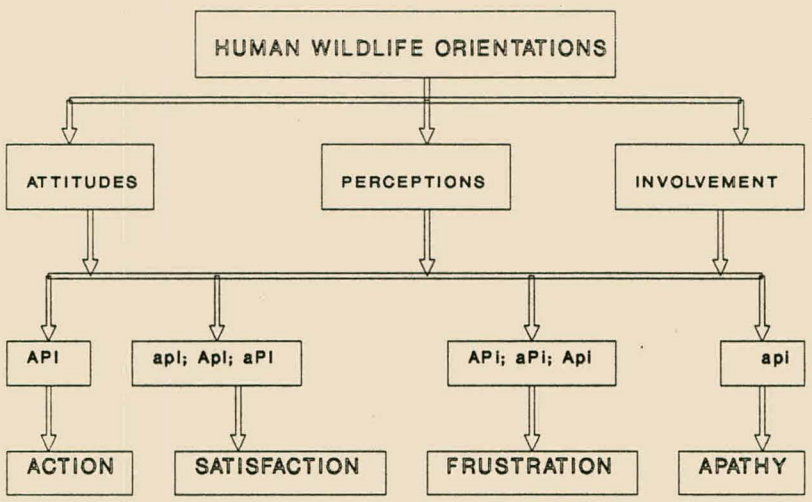

Figure 4.5

Human Wildlife Orientation Categories Model, adapted from Adams, Newgard and Thomas (1986:265). High scores (above the mean) are represented by capitals (A, P,and I), while low scores (below the mean) are represented by lower case a, p and i respectively.

Newgard (1984) further developed this model when she applied it to investigate suspected differences in orientation toward wildlife between a group of college students and a control group consisting of high school pupils. The instrument used to assess the various model components consisted mainly of a series of line drawings with either attitudinal statements coupled with structured response items, or adjective pairs in semantic differential items to assess cognitive aspects.

Extensive factor analysis ensured that those items that did not significantly contribute toward the results were eliminated. Analysis of the test results yielded information about the attitudes of the participants toward the wildlife species in question, and these results were subsequently applied to Adair's model for orientation categories. Not only was a clear distinction between the test groups in terms of the different categories illustrated, but the test items were found to be sufficiently discriminating to enable the researchers to identify different attitude types toward, cognitions of and aspects of involvement in wildlife.

The nature of the test group was such that the two groups were distinctly different in terms of age, education and vested wildlife interests; this selection being necessary to test the sensitivity of the test procedures as well as of the evaluative model.

The most significant advantage of the model was found to be its inherent flexibility:

> ... applications of this model to other audiences ...provides for diversity of interpretations and a focus on cause and effect relationships affecting human wildlife orientations. Herein lies the strength of the model and applied procedures. Through analysis of diverse population responses to each component, educators can develop curricula based on known attitudes, perceptions and actions of public misinformation or uninvolvement. The model, survey and analysis procedures may be applied as a pre- and post-test instrument to school and community education programs designed to address cognitive and affective positions of students concerning wildlife (Adams *et al. : op. cit.*:266).

Although the model has shown potential as an evaluative tool and will probably stand the test of simplicity, in both the applications (LaHart and Tillis 1974; Newgard 1984) it was merely used to "prove" predictable trends. Furthermore, the instruments used for assessing the model components (cognitive, affective and conative aspects of attitudes) are suspect, being based on the assumption that these aspects are measurable with standard structured instruments, "covered" by statistical manipulation to ensure validity and dependability.

Apart from the fact that such practices are based on suspect assumptions, the very nature of the instrument and its dependence on statistical analyses results in this technique being impractical for classroom application.

Although little was learnt regarding the development of a suitable evaluation instrument, except that illustrations could be used to stimulate responses, for the purpose of this study the model has shown definite potential. Apart from its flexibility and apparent adaptability, some other features making it suitable are the following:

* It is sufficiently uncomplicated for application in a classroom situation by the teacher as researcher, and it is independent of statistical analysis.

* The model serves to distinguish clearly between different attitude types or orientations, ranging from more to less desirable and defining the different categories in terms of the cognitive, affective and conative model components.

* The model components coincide with what has been suggested to be the minimum assessable and attitudinal aspects associated with behaviour (see figure 4.2).

* The model is suitable for application by the teacher in various phases of curriculum evaluation. Applied in a context evaluation situation, it can be useful in identifying and interpreting learning needs, thereby assisting in the curriculum planning process. Applied in product evaluation situations, the model may be useful in enabling the teacher to evaluate and interpret possible changes in pupils.

To be of any use for environmental education curriculum development, it should however be further adapted to include a broader spectrum of aspects of the natural environment and conservation. As the successful application of the model depends on the measurement of the model components, a suitable evaluation instrument is regarded as a logical and necessary development.

In the next chapter, the development of such an instrument will be described.

4.3 CONCLUSION

It seems inevitable that for the successful implementation of the principles of environmental education in formal education, adaptations will be necessary not only to teaching methods and materials but also to assessment and evaluation strategies.

In order to develop suitable curricula to incorporate the principles of environmental education the more orthodox approaches to assessment and evaluation aimed at measuring pupils' achievement of cognitive objectives will have to be extended to include a broader approach to curriculum evaluation. Few researchers regard objectives-based evaluation as of much use in the process of curriculum development.

With the need for a broader approach to evaluation and assessment comes the need for the development of additional evaluation instruments. The development of positive values systems in pupils, together with the understanding of certain concepts which will enable the learner to contribute positively toward the general well-being of the environment is a key objective of environmental education. The importance of the development of evaluation instruments designed to collect information about attitudinal aspects of behaviour is therefore obvious. It is also obvious that the utility of such instruments would be greatly enhanced if teachers were enabled to interpret and apply the information thus collected in order to make decisions regarding curriculum objectives, method and materials.

Various researchers are of the opinion that in order to evaluate pupil attitudes, cognitive, affective and conative elements are the minimum variables that should be considered.

The difficulties in evaluating aspects of the affective domain might at first glance seem to render unattainable the ideal of developing such evaluation instruments for classroom use, and the development of a suitable evaluation model poses a particular challenge. A model based on various aspects of pupil behaviour, i.e. cognitive, affective and conative elements, would be useful in enabling the teacher to obtain a more comprehensive impression of pupils either before, during or at the end of an environmental education experience. A number of key aspects were taken into consideration in selecting and adapting a suitable evaluation model:

* Such a model should be applicable to a broader approach to curriculum evaluation. This could serve to assist the teacher to develop a curriculum based on his own empirical research.

* A measuring instrument designed to assess the cognitive, affective and conative elements of pupil behaviour should be developed, taking the following into consideration:

    1. The difficulties surrounding the assessment of attitudinal aspects should be taken into account.

    2. The instrument should be sufficiently simple, adaptable and reproducable so that the teacher could use it in a variety of situations. At the same time it should be valid, reliable and based on accepted principles and models.

    3. The instrument should be easily administered, and the information generated readily interpreted by the teacher as the researcher, and should be independent of complicated statistical analyses.

While the four-dimensional model developed by Newgard (1984) was regarded as having sufficient potential to be further developed for the purposes of the study, no measuring instrument studied was found to be suitable. In the next section of this thesis, the development of such an instrument is described.

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CHAPTER 5

THE DEVELOPMENT, ADMINISTRATION AND VALIDATION OF AN EVALUATION INSTRUMENT TO ASSESS PUPIL COGNITIONS, VALUES AND ACTIVITY WITH REGARD TO THE NATURAL ENVIRONMENT AND CONSERVATION

5.1 INTRODUCTION AND RATIONALE

It was suggested in an earlier chapter that many of the objectives of environmental education correspond with those of biology as a school subject. The development of appropriate strategies that would enable the biology teacher to assess the status of some of the variables of pupil behaviour toward the natural environment and conservation would therefore be a major contribution toward furthering the aims of environmental education.

Environmental education objectives stress the importance of environmental literacy, a term regarded by Sia *et al.* (1986:32) as synonymous with responsible environmental behaviour. It has been mentioned earlier though that **in order to realize these objectives, a teaching approach is needed where aspects such as values education and problem-solving skills together with the creation of awareness of basic ecological concepts will enjoy high priority.**

This can be facilitated if the teacher is supplied with instruments enabling him to investigate more aspects of pupil behaviour than merely the cognitive. Such evaluation strategies may lead the teacher to a better understanding of learning processes and to a greater awareness of educational objectives.

For diagnostic purposes, such an instrument could be applied to assess pupil cognitions of and values held toward a variety of concepts and issues about the natural environment. The model that is described later furthermore enables the teacher to assess the pupil's level of involvement in the conservation of the environment. If any aspects were identified that needed special attention, the teacher would more readily resort to adapted strategies in order to best address

these areas. In this way possible pupil misconceptions could be rectified and the absence of certain desirable attitudes could be addressed by the teacher.

In the previous chapter a suitable evaluation model was discussed. The reliability and validity of this model depend chiefly on the instrument used to assess the different model components in pupils.

In this section the development, administration and validation of an evaluation instrument to assess aspects of pupil behaviour toward the natural environment and conservation is described. Attempts have been made to keep the instrument as simple and the interpretation and application of the results as logical and coherent as possible, while at the same time statistically establishing validity and scientific rationalization.

5.2 THE EVALUATION MODEL

The evaluation model has been adapted from the Human Wildlife Orientation Model as proposed by Adams, Newgard and Thomas (1986) (see chapter 4, p. 60). This model is based on three model components: a cognitive, an affective and a conative component. These components are assessed, and any respondent can score either high (above the mean) or low (below the mean) for each model component. This results in eight possible score combinations, broken down into four orientation categories: ACTION, SATISFACTION, FRUSTRATION or APATHY.

This breakdown is demonstrated in table 5.1

PERCEPTIONS* OF NATURE AND CONSERVATION	**ATTITUDES*** TOWARD NATURE & CONSERVATION	**ACTIVITIES** RELATED TO NATURE & CONSERVATION	CATEGORY
HIGH	HIGH	HIGH	ACTION
HIGH LOW LOW	LOW LOW HIGH	HIGH HIGH HIGH	SATIS-FACTION
HIGH HIGH LOW	HIGH LOW HIGH	LOW LOW LOW	FRUSTRATION
LOW	LOW	LOW	APATHY

TABLE 5.1

The eight possible response combinations used to categorize pupil orientation toward nature and conservation, after Newgard (1984)

* Newgard's use of the terms **perceptions** and **attitudes** is not adequately justified. Especially with regard to perceptions, the test items are clearly designed to assess the **knowledge** of the respondents. In terms of the definition of both these terms in chapter 3 of this thesis, it was decided, for the purpose of this study to resort to the terms **cognitions** and **values** respectively, since these are key elements of attitudes. It was reasoned that this probably conformed more to Triandis's original description of the model components.

This model and the main characteristics of the different categories were described earlier. Adams, Newgard and Thomas (1986:263) have described the characteristics of the orientation categories as follows:

"The "ACTION" category characterizes a person with high aspirations prone to studying, learning and acting;

"SATISFACTION" characterizes a person with low aspirations but some involvement;

"FRUSTRATION" applies to a person with high aspirations, but low involvement;

"APATHY" applies to an individual who is low in aspirations, indifferent and lacking involvement".

It has been shown (Schreuder 1988: see Appendix A) that this evaluation model has some potential in diagnostic application, as specific learning needs in individuals are adequately identified. Applied to a pre-post situation, the model has further potential in demonstrating shifts in the orientation categories from the undesirable to the more desirable, as a result of a learning experience.

A measuring instrument to assess these three model components in pupils was therefore developed.

5.3 THE INSTRUMENT

The instrument was based on the rationale and the learning model discussed in chapters 3 and 4, and developed according to the recommendations listed with the three pilot studies described in Appendix A. It consists of two sections, the first of which was designed to assess cognitions of, and values held toward, certain concepts related to the natural environment and conservation. A second section was included to assess the degree to which participants were involved in activities related to the natural environment and conservation. Each of these sections will be described in more detail.

5.3.1 SECTION B: COGNITIONS AND VALUES

The following thirteen concepts were selected to be represented by line drawings in this section of the questionnaire. These concepts were based on a selection of educational activities to be included in the educational programme (the intervention) prescribed for the experimental group.

1. Natural resources: soil.
2. Natural resources: water.
3. Shortage of water: drought.
4. Dependence of living organisms on natural resources.
5. Adaptations in animals.
6. Decomposition.
7. Role of trees.
8. Food relationships.
9. Human influence: soil erosion.
10. Human influence: pollution.
11. Human influence: deforestation.
12. Human influence: invader plants.
13. Human influence: endangered wildlife.

Seven of the concepts (1, 2, 3, 5, 7, 8 and 9) were selected on the basis of these being representative of the basic ecological concepts in the biology section of the standard six syllabus for General Science. Concepts 4, 6, 10, 11, 12 and 13 were included as these were regarded as basic general concepts or issues of conservation to be addressed in classroom teaching.

In the final questionnaire, these concepts were represented by black and white line drawings, each accompanied by two questions:

"Look at the picture. What does it tell you?"

"How do you feel about it?"

Sufficient space was provided with each of these questions for "open" responses, allowing respondents to write down their reactions in one or two sentences. The first of these questions was to prompt verbal statements representing cognitive elements, and the second was to prompt verbal statements of affect (emotion).

5.3.1.1 Relevant pilot tests

Two of the key components of the final questionnaire (the illustrations and the questions) were investigated by pilot tests to ensure that the concepts were adequately represented visually, and that coherent responses would be prompted.

(i) SELECTION OF THE QUESTIONS

Four explicit and analogous illustrations depicting scenes of pollution were selected, each accompanied by one of the following questions in Afrikaans and English:

1. "What do you see?"
2. "What does the picture tell you?"
3. "What do you think of it?"
4. "How do you feel about it?"

These were presented to 75 standard six pupils from local white schools, and the responses were grouped into four categories: stark description of the illustration, expressions of emotions/feelings, expressions of cognitive elements (recognition of the **concept**), and invalid/insignificant.

The results are represented in Table 5.2

Question	Stark description	Expression of cognition	Expression of emotion	Invalid
1	74,4	24,3	11,2	10,1
2	49,8	**38,5**	**12,7**	9,3
3	26,4	18,1	18,3	28,0
4	28,9	**20,3**	**38,0**	4,4

Table 5.2

Frequencies (in percentage) of responses in reaction to four types of questions

(In the above table, the totals of the frequencies for each question do not add up to 100%, as it was frequently found that responses contained both cognitive and affective elements. These were then recorded in both categories).

All of the questions were found to elicit either stark descriptions of the scene or invalid responses not suited for classification. The latter were usually prompted by specific features in the illustrations, such as objects floating in the water, the factories belching smoke or litter. The **quality** of the illustrations often influenced responses, especially in response to the question: "What do you think of it?"

On the basis of these findings, it was decided to use both questions 2 ("What does it tell you?") and 4 ("How do you feel about it?") as it was clear that collectively, (figures in bold type) these questions would elicit responses of a generally higher quality with regard to concepts and feelings. A total of 51,2% of the responses to question 2 contained recognizable cognitive and/or affective elements (38,5% and 12,7% respectively), while 58,3% of the responses to question 4 contained similar elements (20,3% cognitive and 38,0% affective elements).

(ii) SELECTION OF ILLUSTRATIONS

To ensure that those illustrations acceptably depicting these concepts were selected for inclusion in the final questionnaire, a preliminary questionnaire was prepared and given to 200 standard six pupils from white and black schools to serve as a pilot test.

A graphic artist was assigned to illustrate the selected concepts. Some of these were found to be more difficult to illustrate, such as water, soil, dependence of living organisms on natural resources, erosion, the role of trees and invader plants. For the purpose of this pilot test, these concepts were represented by more than one illustration, with a view to selecting the most suitable.

The illustrations in the pilot questionnaire were accompanied by a single question each, namely "*What do you think of when you look at each of the following pictures*?"

The responses were analyzed and those with comparable content were hand-sorted into different categories. Frequencies for each of these response categories were computed, as represented by the figures with the illustrations. The twenty illustrations used in this exercise together with the respective analyses are included as Appendix B-2.

On the basis of these results, those illustrations that proved too explicit (i.e. were too easily recognized) were eliminated, as they were not regarded as being sufficiently selective and discriminating. For instance, in the case of an unusually high percentage of the participants recognizing a specific concept from an illustration, that illustration was either changed or eliminated. This was however not possible in the case of the illustration of pollution; it was accepted that the high recognition response (93,8%) was a result of a relatively high level of awareness particularly among whites because of publicity given to pollution in the media.

Quite the opposite proved to be the case with invader plants. Although only 6,3% of the respondents recognized the concept from the illustration, very little could be done to improve the illustration to make it more explicit. The suspicion that the average pupil was unfamiliar with this concept was also accepted as having influenced the responses.

Certain features of the illustrations apparently served as some distraction for a significant number of participants, leading to an unproportionally high frequency of invalid and irrelevant responses. Where possible, these features were identified and subsequently omitted or adapted.

As a result of this pilot investigation, those illustrations that were considered suitable for inclusion in the final questionnaire could be selected. Some of these were kept unchanged (nos 1, 5, 7, 8, 14, 15, 16, 17, 18 and 20), some had to be adapted to make them either more or less explicit (nos 4, 10 and 13) while some were eliminated altogether (nos 2, 3, 6, 9, 11, 12 and 19). An important guiding principle in this selection process was that illustrations should wherever possible **be sufficiently discreet to ensure that only respondents who were to some extent sensitized toward the concept would be stimulated to describe the concept, and express emotion toward it.**

Despite these measures little could be done to ensure that the visual expressions of the concepts were equally explicit and clear. It had to be accepted that some concepts are more easily expressed visually, and as a result, more easily recognized. However this factor was kept in mind in the analysis and evaluation of the responses.

5.3.2 THE ASSESSMENT OF THE ACTIVITY COMPONENT

For this component, Section C (see Appendix B-1) consisting of eighteen statements to which the participants were requested to respond on a Likert-type scale by selecting and marking one of three options was included in the questionnaire. These options were:

"I do (or have done) this",
"I have not, but want to",
"I do not want to do this".

Negative as well as positive statements were included. Examples of the negative statements were "Like to pick wild flowers", and "Kill all flies, ants and spiders".

Positive statements included the following: "Go walking in the veld"; "Do project work about nature"; "Help cleaning up litter"; "Join organizations like Wildlife Society, Boy Scouts, etc."; "Like watching TV programmes like 50/50".

The items in this section were selected on the basis of the following:

- Some of the items typify eagerness to learn about nature and conservation, which is one of the characteristics of a person in the ACTION category.
- A number of the items are characteristic of a person with real involvement in conservation activities.
- The negative items characterize a person with expected low cognitions of and undesirable attitudes toward nature and conservation, and is typical of a person in the APATHY category.

Some of these items were taken directly from the questionnaire developed by Newgard (1986).

5.4 THE EVALUATION OF THE RESPONSES

5.4.1 COGNITIVE RESPONSES

The analysis and evaluation of the content of open responses were found to be two of the major problems posed by this investigation. Essentially, most of the difficulties encountered had to do with either the maintenance of objectivity, or to the consistent allocation of equivalent weight to responses to different items.

5.4.1.1 Guidelines and principles for the evaluation of the responses

One of the critical elements in evaluating and scoring open responses is **the consistent application of certain principles**, preferably by one person.

As has been mentioned earlier, one of the major disadvantages of this type of research is the inevitable measure of subjectivity that characterizes the evaluation and scoring of open responses, which may influence the universal validity of the results. However, while no claims are being made that this factor can be completely eliminated, the effect can be minimized by adhering to a number of scoring or recording principles (le Roux and Schreuder 1990:16).

The principles laid down for the scoring of the responses to the questionnaire under discussion were the following:

* **A clearly formulated set of educational objectives in terms of the cognitive, affective and psycho-motor aspects should serve as basis for evaluating the responses.** Here, educational objectives formulated for teaching each concept were used as guidelines for preparing a preliminary scoring scheme based on a three-point scale for both cognitions and values for each of the thirteen concepts included.

* **Certain key words**, especially those expressing certain values, should be identified and listed in a scoring scheme. Examples of these **protocols** in the values category are terms such as **wonderful, concerned, amazing, care for,**

precious, worried, respect, love and others, where applicable. In the cognitions category, terms depicting **cause or consequence, relationships, dependence and importance** are examples. These terms are often included in the formulation of objectives for specific learning experiences about the concepts.

* All **these responses should be treated in their entirety in the process of evaluation.** It often happened that in response to the question "What does it tell you?" respondents made not only cognitive, but also affective statements. The same happened in the responses to the second question of each set, namely "How do you feel about it?" Cognitive statements in response to this question were frequently encountered. In all these cases these responses were coded regardless of exactly where expressions of either cognition or emotions (values) were encountered.

* These principles were continually adapted as the evaluation process proceeded, and a final coding scheme was only fully evolved after all the questionnaires of the pre-test had been coded.

In the process, an attempt was made to establish and maintain equivalence concerning the **quality** of the responses, or significance and relevance of content. For example, mentioning possible consequences of human actions such as pollution, deforestation, erosion or endangered species were regarded as being of comparable quality and scored 3, while mere recognition scored 2; recognition of the somewhat concealed concepts (as identified in the pilot test) such as erosion, invader plants, decomposers, food chains, adaptations and interdependency scored 2.

Valid responses that were encountered and not anticipated beforehand, were considered and compared with other responses to the same item. These anticipated responses were then ranked and included in the scoring scheme. As a result, it was necessary to double-check all the questionnaires to ensure consistent and uniform coding.

5.4.1.2 Application of scoring principles

In the next paragraphs examples of the more detailed application of the scoring principles with regard to the individual concepts are described. (Examples of actual responses quoted to illustrate certain aspects are printed in italics.)

1. Stark descriptions of the illustrations scored 0, except in those cases where certain aspects of the concept were described in the response (e.g. *bird eating a worm, or bird finding food* in the illustration depicting food relationships; *trees being chopped down* in the illustration depicting deforestation). These responses scored 1.

2. A score of 1 in the cognitions and values categories was also given in those cases where respondents gave a doubtful or vague expression of recognition of the concept, or in the expression of feeling. In cases where feelings such as **unhappy, cross, happy** (for bird finding food; water in the pool) **sad, terrible, disgusting** etc. were expressed, one point was allocated **only if these were qualified** (e.g *Happy that we have the sun and water*; *Terrible to see what man has done*)

3. For those items dealing with human actions (erosion, deforestation, etc.) a score of 2 was given for responses indicating **full recognition of the concepts depicted, but without stating any causes or possible consequences** (e.g. *We have too many exotic trees*; *These are endangered species*). Dubious or vague expressions of concern or wonderment, whichever applied, likewise scored 2 (e.g. *What will happen to the animals if all the trees are chopped down*?; *Erosion must be stopped...*).

4. A score of 3 was given to those responses indicating full recognition of the concept depicted, coupled with the following:

   * some explanation of the concept or issue in question, (e.g. *Giraffe is taller than the buck so it can eat fresh clean leaves from the high trees; All animals need other living things for their food)*

* possible causes for, or effects of the phenomenon depicted, (e.g. *Erosion has taken place as a result of human mistakes; No soil, no plants and therefore no life*; *Man has caused these species to become endangered)*

An exception was made in the case of the concept of pollution, as it was decided to score 1 for the response "pollution", although the respondent thereby indicated recognition of the concept depicted. Likewise, an expression of aversion in a response to this item scored 1 in the values category. This was justified because of the explicitness of the illustration as pointed out in the pilot test, and to ensure equivalent weighting of responses to different concepts.

In order to score three points for this item, respondents had to expand on this concept. The following is an example of an actual response that scored 3 in the cognition category:

People *pollute and* destroy *our environment* (key words emphasized).

Strong expressions of concern (about the concepts of drought, erosion, pollution, deforestation, invader plants and endangered species) or wonderment, awe and respect (with regard to the concepts of soil, water, dependency, decomposers, the role of trees and food chains) scored 3 in the values category (*We must care for our water, and carefully manage this resource*; *God was not mistaken when he made the giraffe to have a long neck, He knew that its neck would be a great help to it*; *It was human error that caused it, and now we will have to put it right* [endangered species]).

The full scoring scheme for the cognitions and values categories is included as Appendix B-3.

The maximum scores for both cognitions and values was 39, the totals being labelled C and V respectively.

5.4.2 CODING THE "ACTIVITIES" COMPONENT

The coding of the "activities" responses was standard practice as these were structured. The respective options were coded as follows:

I do (or have done) this scored 2, *I have not, but want to* scored 1 and *I do not want to do this* scored 0 for all the positive statements. In the negative statements the scoring was reversed with *I do not want to do this* scoring 2, and both the other responses scoring 0.

The maximum score for this section was 36, and the total score obtained by any respondent for this section was labelled A.

5.5 THE ADMINISTRATION OF THE QUESTIONNAIRE

5.5.1 SELECTION AND BRIEFING OF PARTICIPANT TEACHERS

As the main objective of this project was to produce an evaluating instrument **to be applied in a classroom situation,** it was considered important that teachers should participate in its administration.

Eight white teachers enrolled for participation in the project because of interest in environmental education and evaluation; three more (1 from coloured, and 2 from black schools) were approached to participate.

During a workshop session these teachers were introduced to the theoretical basis of the evaluation model and that of the accompanying measuring instrument.

As the evaluation model and the instrument were to be used in a pre-post investigation involving a control group as well as a test group in a quasi-experimental design, the proposed procedure was discussed. The participating teachers were requested to administer the questionnaire to one of their own standard six classes serving as an experimental group, and a comparable group of standard six pupils not being taught by the teachers themselves serving as a control group. This was necessary to avoid possible contamination, as for the success of this phase of the investigation it was important for the control group not to be exposed to the aspects of the intervention. They were also requested wherever possible not to select the groups on the basis of academic proficiency, as this might influence the results.

The activities from the Educational Resource Package which were to form the basis of the intervention were subsequently discussed. Particular attention was paid to the objectives of the respective activities selected.

Teachers were requested to encourage participants to complete the questionnaire items in their home language, regardless of the languages used in the questionnaire. This was done especially to accommodate black pupils who, although they are being taught through the medium of English, might find it difficult to express themselves, and particularly their feelings, freely in an open response.

The pre-tests were administered in February-March of 1989 in eight white, one coloured and two comprehensive black secondary schools in the Western Cape. Except for the black schools, the schools were selected to be representative of urban and rural areas.

5.6 THE TEST GROUP

The test group consisted of 611 standard six pupils, with sexes and living area more or less evenly represented. With regard to home language, the Afrikaans-speaking pupils were in the majority and with regard to ethnic groups the white pupils were in the majority. Full details of the composition of the group are given in Table 5.3

GROUP VARIABLE		N	%
SEX	FEMALE MALE	396 215	64.8 35,2
AREA OF RESIDENCE	FARM CITY VILLAGE	65 326 220	10,6 53,4 36,0
HOME LANGUAGE	AFRIKAANS ENGLISH OTHER	318 107 186	52,1 17,5 30,4
ETHNIC GROUP	BLACK COLOURED WHITE	181 56 374	29,6 9,2 61,2

Table 5.3

Composition of the test group (pre-test)

The black pupils were included to investigate the applicability of the instrument, but also to possibly confirm a hypothesis formed during an earlier investigation (see Appendix A) that cultural background and socio-economic circumstances might have an influence on the pupils' perceptions and attitudes regarding the natural environment and conservation.

5.7 VALIDATION EXERCISES

5.7.1 CORRELATIONAL VALIDITY

To confirm the validity of the test results, exercises were carried out to test both the correlational and predictive validity. One of these exercises was based on pre-test results, while another took both pre- and post-test results into consideration.

Correlational validity is defined as "...the degree to which findings obtained by one method correlate with findings obtained by another and thus justify their substitutability" (Krippendorff 1980:157).

Alternative assessment methods for cognitions of the natural environment and values held toward it had to be designed to confirm whether the results of this investigation were a true reflection of these aspects. Furthermore it had to be established whether there was any correlation between the results of the activities section - consisting of statements of behaviour by respondents with regard to the natural environment and conservation - and the overt behaviour of the respondents.

It was decided that for the confirmation of the results for cognitions and values, interviews with a randomly selected group of pupils who had completed the questionnaires would serve the purpose.

Confirmation of the second aspect (the activities section) was more troublesome, and built into the design of the investigation were interviews with the participating teachers after the completion of the post-test. This exercise served a dual purpose:

1. Any dramatic changes (or no significant change) in either cognitions or values, or both, identified by the post-test could possibly be explained by the teacher;

2. Any improvement (or no change) in the measured behavioural aspects of the respondents could be confirmed by the teacher who had had the opportunity to observe overt behaviour of the pupils for at least eight months.

5.7.1.1 Interviews with randomly selected respondents

Random samples of five pupils each from one black and one white school, all having recently completed pre-test questionnaires, were drawn for interviews. These pupils were all drawn from the control groups, as some of the experimental groups had at that stage already been subjected to the intervention.

General questions were asked during these interviews to minimize the effect on the pupil of being submitted to an oral test as well as some similar, but not identical, to those contained in the questionnaire. An effort was made to cover as many as possible of the concepts contained in the questionnaire.

The following were asked during these interviews, with the corresponding questionnaire concepts in brackets. Where it was necessary to prompt, additional questions were asked. These are indicated by *.

1. What can you tell me about soil? *How important is soil to you? *Do you think we have enough soil? (concept 1).
2. How important is water to you? *Do you think we have enough water? (concept 2).
3. What do you think of when you see a bird catching an insect? (concept 8).
4. Why are trees important? OR Do you like trees? Why? (concept 7).
5. What do you think when you see flies sitting on a dead thing? (concept 6).
6. What will happen if there is no more sunlight? *Why is the sun important? (concept 4).
7. Why has a giraffe such a long neck/ has a chameleon such a long tongue/has a sunbird such a long beak? What do you think of this? (concept 5).

8. Can you name a few things that people do to harm nature? What do you think of these? (concepts 9, 10, 11, 12, 13).
9. Can you name any plants or animals that you are worried about? * Can you name any plants or animals that might disappear altogether? What do you think? (concept 13).

The interviews, held after school hours, lasted fifteen minutes each. Recordings were made, transcribed and subsequently analyzed in a similar fashion to the written responses. These responses were then compared to those of the questionnaire.

In Table 5.4 a number of examples are given of responses to the questionnaire compared with those of the interviews.

A minus sign denotes an interview response that was scored lower than the questionnaire response of the same respondent, and a plus denotes a better interview response. Examples of both cognitive (C) and affective (V) responses are included.

Dif.	Questionnaire Response	Interview Response
-3	Flowers eaten by grubs,which are again eaten by bird (C=3)	I don't like it, but I suppose they must live (C=0)
-2	A dead fish eaten by flies (C=2)	I don't like it; flies just spread disease (C=0)
-1	... water, necessary for people and plants (C=2) I feel that God made important things for nature (V=1) Good - the bird gets food (C=1)	Where I live, we have enough water (C=0) Sun keeps us warm (C=0) Sad that the worm must die (C=0)
0	Makes me think of life on a farm (C=0) ...dam where a stone was thrown into the water (C=0) Without sun ... there is no life (C=3) Sun gives energy (C=3) Sun is important for men and animals (V=2)	makes me think of harvest; ... stand on it (C=0) Think of swimming pool, can drink it (C=0) There is no life without sun - gives ... energy (C=3) Sun is important for plants (C=1) ... important for life (V=2)
+1	Everything needs water to produce products (C=2) (Trees are) pretty (V=0)	One of the most important things; can't live without it ... (C=3) It helps people ... fruit and shade... (V=1)
+2	Bird finding food for young (C=1) Calm and restful ... (V=0)	Reminds me of a type of food chain (C=3) Water is life; it's clean we must save (V=2)
+3	Farm where we get food (C=0)	One of the most important things; get food from it, live on it, and we can't get more soil ... (C=3)

Table 5.4

Comparison of some interview responses with questionnaire responses.

The frequencies of the differences between written and oral scores were determined, and are represented in Table 5.5 below:

DIFF	-3	-2	-1	+1	+2	+3	No Diff
COG	1	5	15	43	18	7	1
VAL	0	0	13	53	19	5	0

Table 5.5

Frequencies of differences (written score - oral score) recorded per concept covered during the interview.

With regard to the cognitive responses, 28,9% of the total oral responses scored higher than the corresponding written responses, while 23,3% were scored lower. For the affective responses, these figures were 26,7% and 14,4% respectively. A total of 43% of the cognitive responses, and 53% of the affective responses were of comparable quality, as no meaningful differences were recorded. Although these figures appear to support the correlational validity of the measuring instrument, this could not be proved conclusively, as a number of practical problems were encountered.

The most troublesome aspect of this exercise was that certain key words in the phrasing of a question were found to influence the pupil's response. For instance, it could not be expected that a question such as: "Do you think that all living things need water, soil and sunlight?" could prompt a response equivalent to one elicited by an abstract representation of the concept. Furthermore, a recognition of the pine tree as an example of an invader species was a prerequisite for a valid response to the illustration of the concept. It was difficult to phrase a question in this regard without mentioning either the name of a plant, or the term invader species. For this reason, only a limited number of those concepts about which logical questions, analogous to those of the questionnaire, could be asked, were considered valid for the purpose of the interviews.

It was often found that the responses to the questions did not always come spontaneously, especially in the earlier stages of the interviews. The "guinea-pig-effect" obviously influenced the reactions of the pupils. It was clear that the pupils were not familiar with this practice, and this may have seriously affected the outcome of this exercise. It would be a better strategy to involve the teachers in the interviews, in which case a larger number of respondents could be involved, and since the pupil would be more familiar with the teacher, the possible intimidating effect on the pupil of having to respond to the questions of an unfamiliar person might be minimized.

As validation this exercise therefore did not yield conclusive evidence. In retrospect the nature of the open response might possibly be the most fundamental problem in accomplishing valid results through interviews. Furthermore, the size of the groups interviewed was too small for any conclusive inferences to be made.

5.7.1.2 Interviews with participating teachers

Interviews with all the teachers who were involved in the intervention and administration of the post-tests were conducted after the results of the post-test were compared to those of the pre-test. Similarly, the results of the experimental groups were compared to those of the control groups.

The instrument identified improvements with regard to cognitions, values and to some extent activities in both groups, although more significant improvements were identified in the experimental groups (see chapter 6).

The interviews were to serve the following purposes:

1. a possible confirmation of the improvements identified by the instrument;
2. confirmation of the differences identified:
   * between **control and experimental groups** in the post-test;
   * in the improvements measured **in different concepts in the same school;**
   * in the improvements measured in the **same concepts in different schools;**

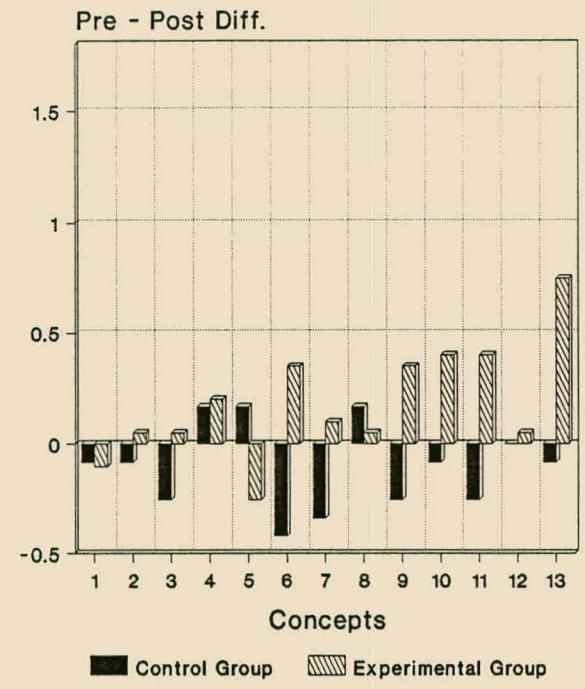
3. to obtain some feedback about the suitability of the measuring instrument for possible classroom application;
4. to establish whether there was a positive correlation between overt behaviour and the measured change in behaviour.

For this purpose the results per concept were presented graphically for each individual school, with group means for each concept. The examples included represent the data for two randomly selected schools.

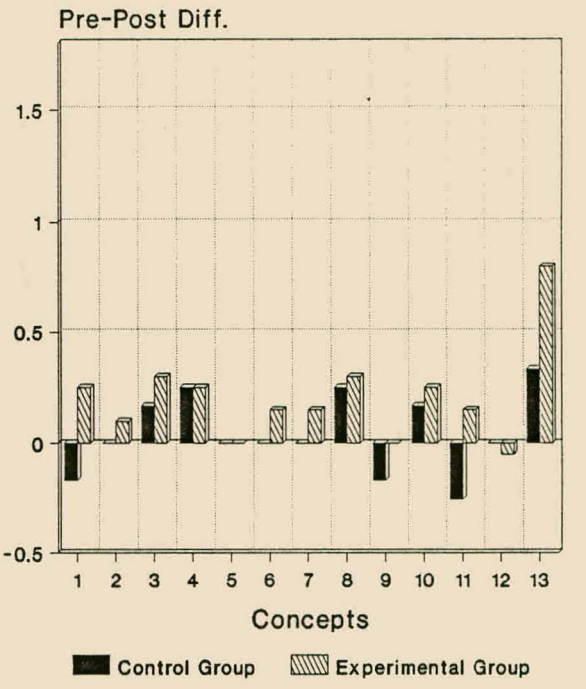
This exercise proved to be more valuable than the previous one in that a number of tendencies measured by the instrument were confirmed.

First, the varied nature of improved cognitions and values as indicated by the test results was apparently not due to inconsistency of the instrument. There was conclusive evidence that **the intervention varied considerably from school to school.** This information was obtained from individual teachers before the results of their groups were discussed with them. It was found that while some teachers left the pupils to do the activities entirely on their own, others gave proper guidance and supervised pupil activities. It was also found that all the teachers stressed only some of the activities, and some of the other activities received little or no attention because of a number of local circumstances. Few of the activities were found to have been integrated into classroom teaching as all the teachers taught the activities as a separate unit.

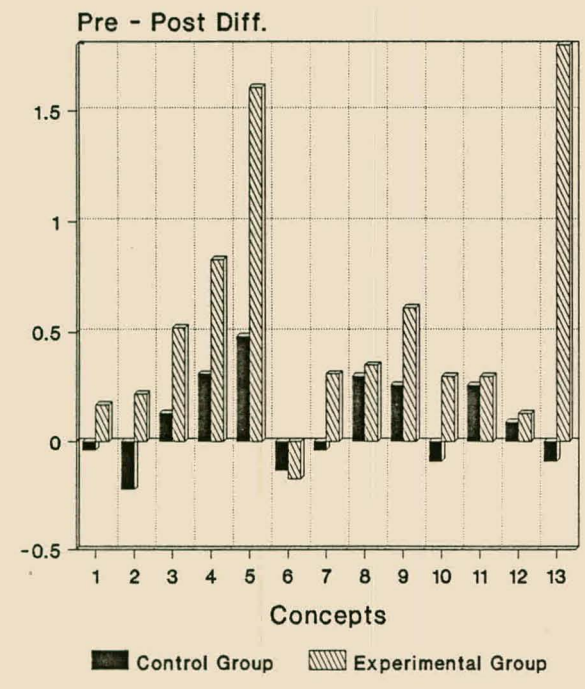
Although it is not possible to verify it statistically, this exercise could serve as validation of the instrument, as most of the tendencies are reflected in the results as measured. An example to illustrate the point is the substantial inprovement in cognitions (53,6%) and values (16%) regarding adaptations (concept 5) found among the experimental group in school 2 that was obviously the result of the fact that the teacher conducted two activities on the topic, and the pupils participated in the classroom activities. Without being aware of the test results, the teacher reported that these activities were thoroughly enjoyed by all the pupils. In the same school, however, no measurable improvement in either cognitions or values with regard to decomposers (concept 6) was identified. This was accounted for by the report of the teacher that the activity based on the role of decomposers was not done at all.



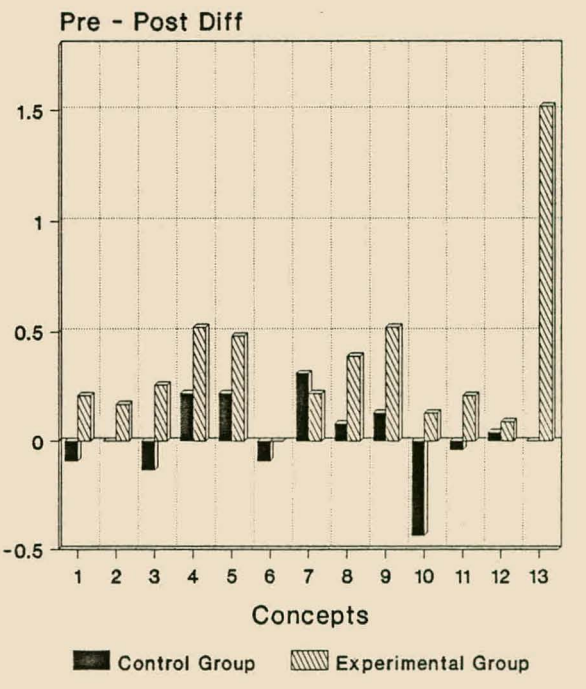
School No.1: Cognitions



School No. 1: Values



School No. 2: Cognitions



School No. 2: Values

Figure 5.6

Graphic representations of changes in cognitions and values of experimental and control groups in two randomly selected schools, as presented to participant teachers during interviews.

In school 1 a significant improvement (25% and 26,7% respectively) in both cognitions and values about endangered species (concept 13) was accounted for by the teacher's report that pupils were requested to bring to the classroom press cuttings on endangered species, and to display on the classroom noticeboard pictures of endangered species. Group discussions followed during which pupils had to express their views and share information on this topic.

In the same group the substantial improvement in values and cognitions about erosion (concept 9) and the role of trees (concept 7) (for which relatively high average marks had already been recorded in the pre-test) was explained by some unexpected factors. In the town where these pupils live, the local authorities allowed the burning and removal of pine trees on a mountainside, resulting in erosion of the mountain slopes.

However, in this same school on the other hand, the teacher did not have time to include the activities on adaptations. This was reflected in there being no measurable improvement in either cognitions or values about this concept.

The results of the activities component partially confirmed a suspected weakness of the instrument. Changes measured in a number of cases did not always correlate with changes in the other components, as there was evidence that in at least two schools changes in the overt behaviour of pupils was not reflected by the results obtained by the measuring instrument. In school 5 the teacher reported a campaign launched by the pupils of the experimental group for the eradication of alien plant infestation in the neighbourhood, and letters having been sent to the local authorities to ask for assistance. This was not reflected in the average improvement in the activities section.

The teacher of school 11 reported a substantial observed improvement in awareness among the experimental group during the intervention. This resulted in overt actions such as fund raising efforts for conservation causes, hacking sessions and beach clean-ups. Neither of this improved awareness, nor the improved behaviour was reflected in the test results. The former was explained by the fact that major disruptions in the school programme as a result of centenary celebrations resulted in the inconsistent completion of the questionnaire by the majority of pupils, a number of whom had to take the questionnaire home for completion under uncontrolled

conditions. In this school the control group recorded more favourable changes with regard to a number of concepts.

As a validation exercise, the teacher interviews were valuable and encouraging. Although some of the tendencies identified by the instrument could not be accounted for, the majority were satisfactorily confirmed.

5.7.2 PREDICTIVE VALIDITY

Predictive validity is defined as "... the degree to which predictions obtained by one method agree with directly observed facts. In content analysis, predictive validity requires that the obtained inferences show high agreement with the states, attributes, events or properties in the context of data to which these inferences occur..." (Krippendorff *op. cit.*:157)

In an effort to establish predictive validity, the questionnaire was administered to an adult group (n = 50). Part of this group consisted of 25 selected biology teachers, teacher trainers and teachers in training (Group PVB), **with expected high levels of cognitions of the natural environment and conservation and positive value systems toward them.** The rest of the group consisted of randomly selected university students and members of the public with no particular known connections with biology or environmental education (Group PVH, or Control Group).

The main purpose of this exercise was to test the following hypotheses:

1. The instrument distinguishes adequately between people according to their cognitions of the natural environment and conservation and the values held toward it.
2. The evaluation model is valid in that **a person with known or expected high levels of sensitivity toward, awareness of, and involvement in the natural environment and conservation, is likely to be classified in the ACTION category**; conversely, that **a person with no expected high cognitive levels of, and/or an attitude of indifference toward nature, and/or a low level of involvement in conservation is likely to be classified into either the SATISFACTION, FRUSTRATION or APATHY categories.**

The responses were analyzed and compared according to the same scoring principles as those applied for the participants in the project. As this was done after 1 000 questionnaires had been scored, the mark scheme was well established. The consistent coding which is required for this exercise was thus highly probable.

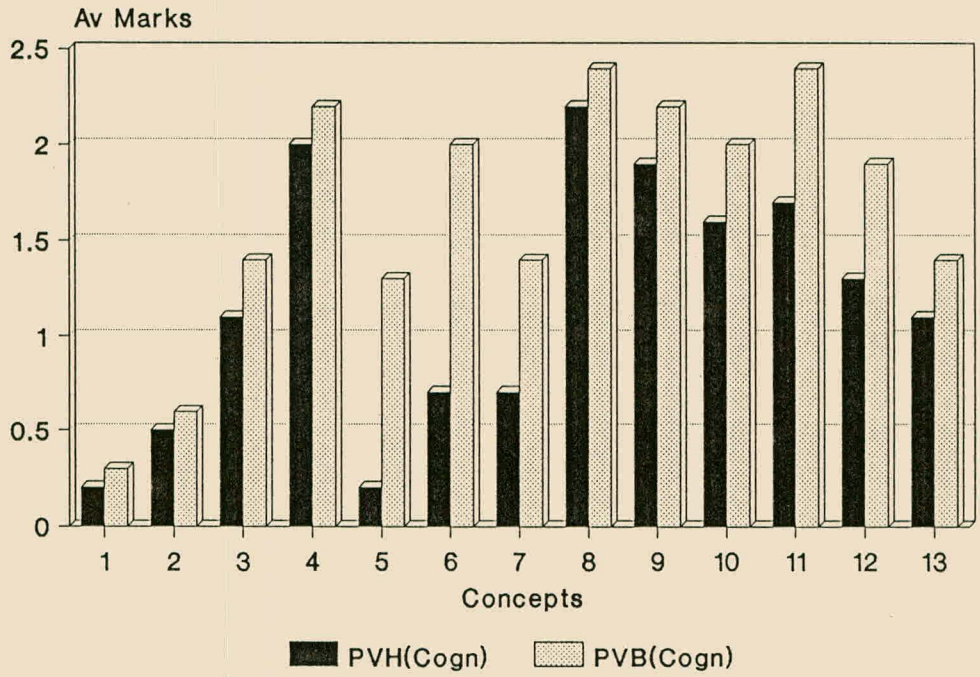


Figure 5.7(a)

Graphic representation of a comparison of average cognition marks of two test groups.

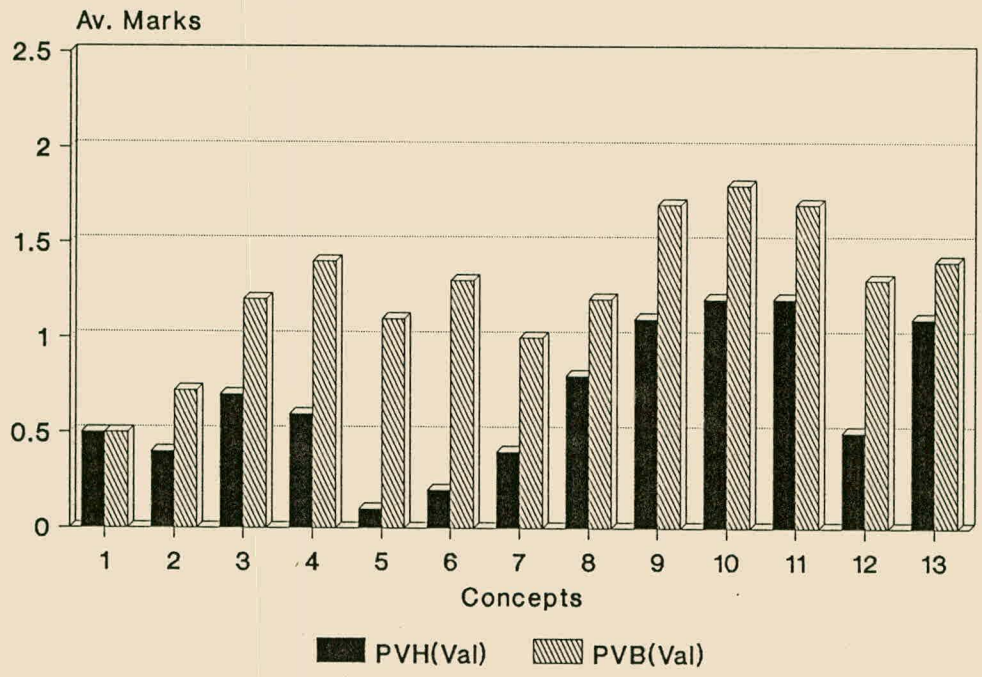


Figure 5.7(b)

Graphic representation of a comparison of average values marks of two test groups.

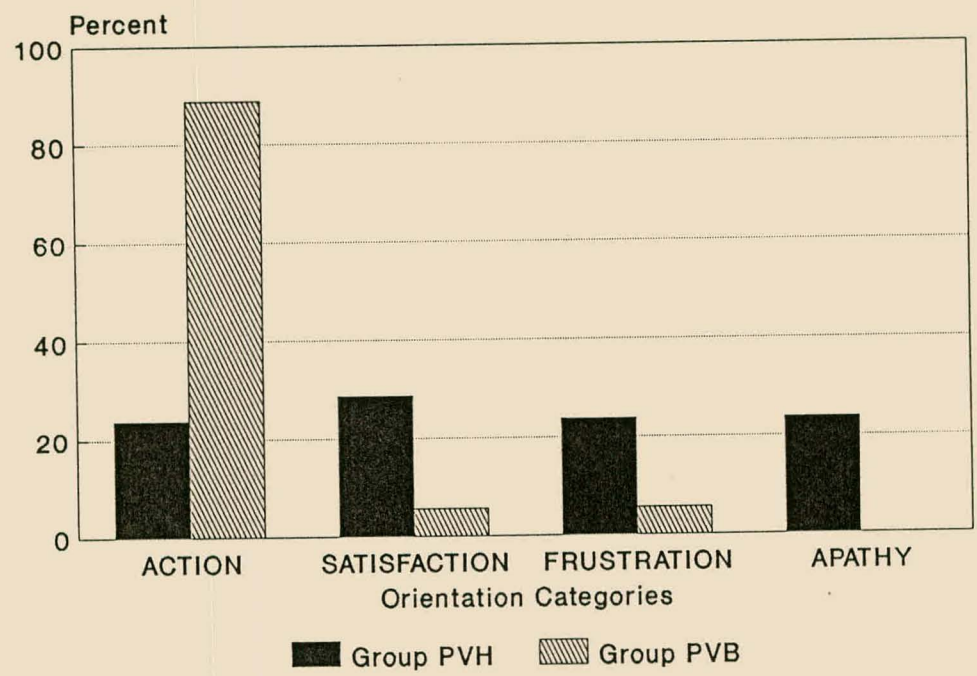
These graphic representations indicate a substantial difference in both cognitions and values for most of the concepts. Two features are worth mentioning:

1. In the more specialized ecological concepts (adaptations [5], food chains [8] deforestation [11] and invader plants [12]) the differences between the two groups were more substantial, which is to be expected.
2. The differences between the two groups in the values component for all the concepts were more dramatic than those in the cognitive component. In only one concept (soil) [1] was no difference between the groups recorded.

These findings support the first hypothesis, namely that the instrument distinguishes between people according to their cognitions of the natural environment and conservation and values held toward it.

These results were applied in the four-dimensional evaluation model with a view to confirming the second hypothesis.

In fig 5.8 this breakdown is represented graphically.



Alternative Means: 14, 9, & 26

Figure 5.8

Comparison of orientation categories of groups PVB and PVH. (Model component means: cognitions -14, values - 9 and activities - 26)

The means for the three model components were based on the totals of these two groups and those of the pupils.

Some basic differences in orientations are demonstrated by this representation. The respondents in the PVH group, who may be representative of the general public, are evenly distributed over the four orientation categories. The respondents in the PVB group however, are concentrated in the ACTION category, with only 5,6% falling in the SATISFACTION, and the same number in the FRUSTRATION categories.

These findings therefore support the second hypothesis, namely that **a person with known or expected high levels of sensitivity toward, awareness of and involvement in the natural environment and conservation is likely to be classified in the ACTION category**, and that **a person with no expected high cognitive levels of, and/or an attitude of indifference toward nature and/or a low level of involvement in conservation is likely to be classified into either the SATISFACTION, FRUSTRATION or APATHY categories.**

Furthermore, it served to demonstrate the flexibility of both the instrument and the model, as this group included respondents ranging in age from 20 to 55 years.

5.8 CONCLUSION

The actual development of the instrument described in this chapter was considerably simplified since problems usually encountered in the development processes of an instrument of this nature were solved in related pilot studies described in Appendix A. Aspects such as the response type, the visual stimuli and the questionnaire format as well as the scoring of open responses and the application of the evaluation model have to various degrees been refined and established.

Most of the problems encountered during the developmental phase were related directly to the following aspects:

1. An instrument designed for classroom use, especially when unconventional techniques are applied, should be kept simple and at the same time be logical and scientifically justified. Such an instrument should furthermore be sufficiently adaptable to enable teachers over a wide spectrum to use it in a variety of circumstances.

2. The practical evaluation of aspects of the affective and conative domain was experienced as particularly troublesome, but is perceived to have a key role in the proper development and assimilation of an environmental education approach in formal education. In an effort to solve some of these problems, the technique of combining visual stimuli with open responses was applied.

3. Although it was found that for this purpose the approach has sufficient potential to be used by teachers and environmental educators, the evaluation of these responses may be the most arduous and controversial aspect of this evaluation technique. Major efforts have been made to establish a scheme of scoring principles to facilitate this process.

4. Another problem encountered was the validation of the instrument. To investigate its correlational validity, it was important to find alternative methods to assess the cognitive and affective model components. The pupil interviews, while yielding no evidence that the results of the instrument were unrealistic and not representative of reality, could however not be used to confirm the validity of the results statistically. The teacher interviews were more valuable, as certain tendencies of the cognitions and values of the different concepts measured in some of the schools were explained, confirming to a certain degree the validity of the instrument.

   As for the predictive validity, more promising results were obtained by administering the instrument to a group of adults. Not only was there sufficient evidence that the instrument distinguishes between people with expected different attitudes toward the natural environment and conservation, but these differences were more explicitly demonstrated by the evaluation model.

5.8 REFERENCES

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CHAPTER 6

ANALYSIS OF QUESTIONNAIRE RESULTS AND THE APPLICATION OF THE FOUR-DIMENSIONAL EVALUATION MODEL

6.1 INTRODUCTION

The analysis and interpretation of the responses to questionnaires administered to 611 standard six pupils yielded a substantial amount of information, especially about the cognitive and affective aspects regarding the concepts included in the investigation.

These concepts are discussed individually, and elucidated by some of the actual responses elicited, and how these were scored. Subsequently the full results are presented simply and logically as this evaluation technique has been developed for classroom application. Where possible, standard statistical analyses were used to confirm the validity of some of the trends identified.

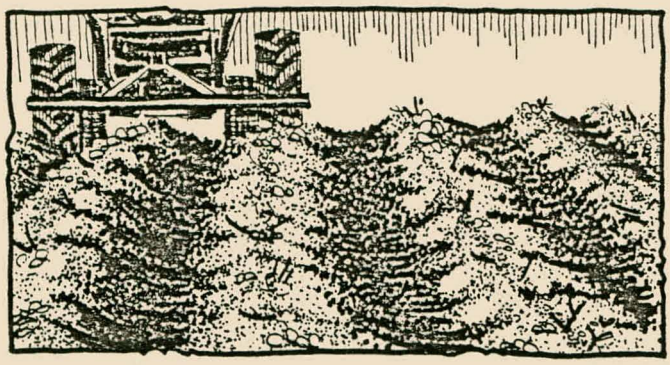
6.2 RESULTS OF THE PRE-TEST (n = 611)

6.2.1 SECTION B: COGNITIVE AND AFFECTIVE TEST ITEMS (See Appendix B-4(a))

The discussion of each of the concepts contained in the questionnaire includes the actual illustrations of the concepts as used in the questionnaire to depict the concepts. Some typical responses as well as some of the main trends are mentioned.

Frequent comparisons are made between the responses of white and black respondents, as in most of the test items certain characteristic tendencies of black/white differences are apparent. As these tendencies are not reflected in the tables and graphic representations in which, for statistical purposes, the group was treated as an entity, any such tendencies are featured in the following paragraphs.

6.2.1.1 SOIL



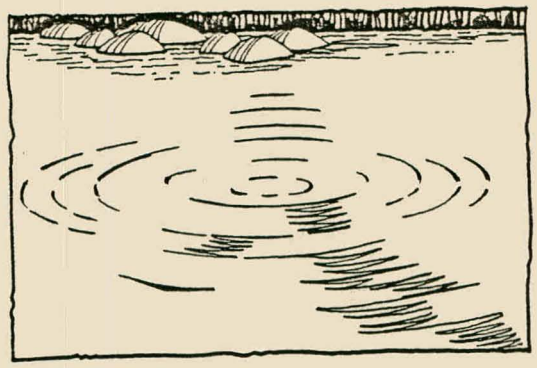
The ideal response in the cognitive category would be along the lines of **"...soil, a valuable non-renewable natural resource"**, and some strong expression of concern or care in the values category.

None of these were found, although some interesting other responses were encountered. The black respondents, in particular, **frequently expressed man's dependence upon the soil for food.** This response was awarded two points, and 8,8% of black, as opposed to 2,4% of white respondents reacted in this way. A possible distracting feature of this illustration could have been the tractor ploughing, as 19,3% of the black and 8,8% of the white group referred to aspects of cultivation. These responses were awarded one point.

In the **values** category a substantially higher percentage of black than of white participants expressed some feeling about the importance of the soil in providing food for man, animals and plants ("...everything grows in soil. I feel good because we are dependent on plants").

In both the cognitive and the affective categories however, the number of invalid responses (i.e. concentrating on the tractor) was unexpectedly high (84,3% and 79,1% respectively). This is an indication that the illustration probably did not depict the concept adequately.

6.2.1.2 WATER



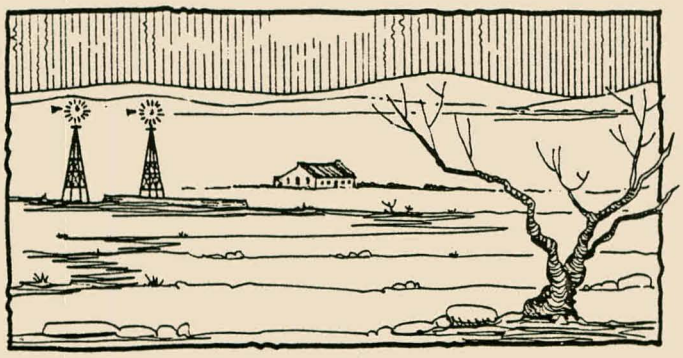
The ideal cognitive response to this item is some reference to **water as a precious and life-sustaining natural resource, and the great importance of careful management of water resources.** In the affective category a strong concern for and dependence on water as a natural resource was expected.

The difference between the responses of black and white respondents was more obvious for this item. Where 88,8% of the white group did not score any points, only 18% of the black group were not awarded any points in the cognitions category. The findings were similar for the values category. While the white group scored the lowest average in this item as compared to the other items, the highest average was scored by the black group. This difference was found to be highly significant (χ^2 = 0,0000).

The main reason for this must be the fact that a high percentage (81,8%) of black participants recognized the concept depicted **water** as a natural resource and stressed the uses of water (drinking, cooking, washing). Likewise, in the values category 59,7% of the responses of this group was scorable (ranging from expressions of dependency on clean water to the need for keeping water clean and using it sparingly) as opposed to 17,1% of the white group.

A large number of white respondents concentrated on features such as the ripples on the water surface ("...somebody has dropped something in the pool", "whirlpool...") This must be regarded as a significant distracting factor, although the illustration proved to be effective for the majority of black respondents.

6.2.1.3 DROUGHT



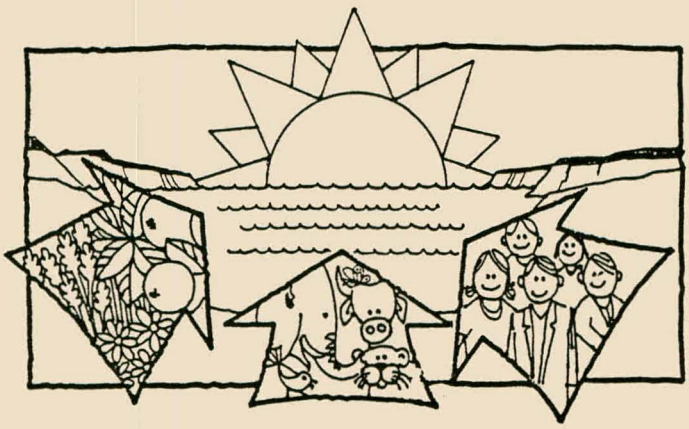
The ideal response is a recognition of a water shortage and its effects, and strong expression of concern for the effects of water shortage on agriculture, the land and plant and animal life.

Although the scores in both categories for the white respondents were substantially higher than those of the black group, the differences were not as pronounced as for the previous item. Of the black responses, 73,5% were classified as invalid (i.e. purely descriptive, or referring to specific features like the house, the tree, the windmill or the farm). Among the white group however, the concept (water shortage) was adequately recognized, resulting in an average cognition point falling in the upper half of averages, with 34,5% (where these are compared for individual items) not scoring any points.

A few examples of actual responses with the respective scores are listed below:

"There is no water here" and "...place that needs water" (C = 2); "...feel bad as there is no food or water for animals" (V = 3); "not happy, animals need water" (V = 2).

6.2.1.4 DEPENDENCY OF LIFE ON RESOURCES LIKE WATER, LAND AND SUNLIGHT



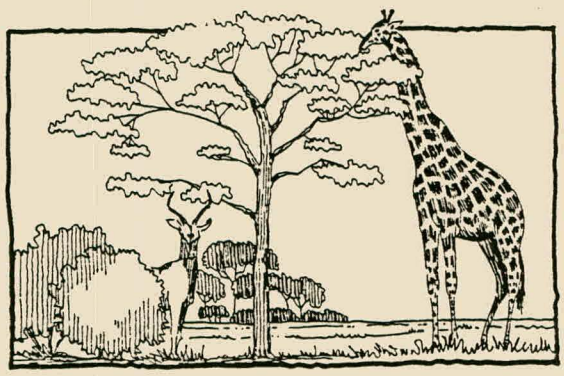
The ideal cognitive response is some recognition of the dependency of living organisms on natural resources such as sunlight, water and land, as well as on other organisms. In the affective category, respondents were expected to express wonderment and respect. Mentioning dependency on any **two** of the resources scored full marks for cognitions.

The prominence of the sun and the interconnecting arrows led to a relatively high average mark for both values and cognitions. Responses like "...shows the important thing - the sun", "...from sun, water and soil we can produce oranges, and flowers, and it helps to keep people alive" occurred frequently. In expressing values, responses like "...God has given us these things, as we need it to live" (V = 2) and "...feel grateful that we have a sun that is like a life-support system" (V = 2) were regarded as high-quality responses.

There was a highly significant (χ^2=0,0000) difference between white and black responses for both cognitions and affect expressed. While 38,0% and 67,6% of the white respondents did not score any points for the respective categories, the corresponding figures were 60,8% and 80,7% respectively for the black participants.

Possible distracting factors may have been the "happy faces" of the people and animals, and even the beach, sun and a holiday atmosphere apparently conveyed by the illustration. This probably accounts for the large number of invalid responses.

6.2.1.5 ANIMAL ADAPTATIONS; NICHES



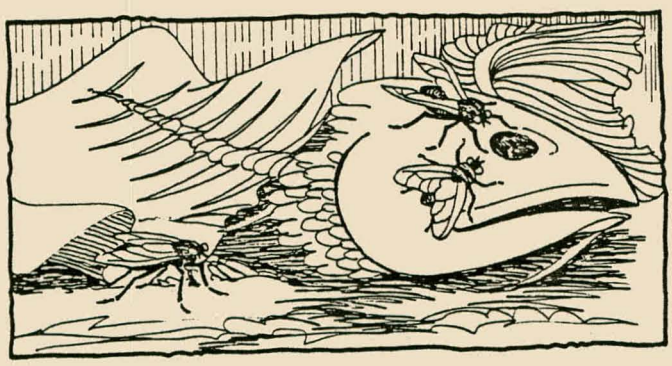
Ideal cognitive responses would be the recognition of the adaptation concept by reference to either the long neck of the giraffe compared to that of the kudu, or its colour, or the niche filled by the animal. Respondents were expected to express wonderment and respect in the affective category.

Such responses were recorded in a total of only 2,3% of the cognitive responses, and no significant differences in the responses of the different groups were recorded. A total of 87,4% of the responses could not be considered for scoring.

In the affective category, only 15 (2,5%) of the responses could be scored indicating that the majority of participating pupils were not familiar with the concepts of

adaptation or niches. Despite this, some stimulating responses were recorded, such as "...God did not make a mistake when He created the giraffe to have such a long neck, He knew it would be a great help to it" (V = 3); "Giraffe is taller than the buck so it can eat fresh clean leaves from the high trees..."(C = 3). Lower quality responses were "...giraffes have such long necks compared to other animals" (C = 2) and "The giraffe is taller than the tree"(C = 1).

6.2.1.6 DECOMPOSERS AND RECYCLING



Respondents could score three points in the cognitive category by expressing recognition of the important role being played by decomposers in recycling organic remains. The affective expressions were expected to contain elements of awe, wonderment and respect for natural cycles.

A relatively small number of respondents recognized the concept, with 58,3% not scoring in the cognitions category and 85,4% not scoring in the values category. As a result, this item was ranked very low on averages (no.8 for C, no.11 for V). A significant number of black respondents referred to the danger of flies spreading disease, while white respondents tended to refer to **pollution**, and expressed aversion at the sight of decaying matter and flies.

Some of the responses recorded for this item are the following:

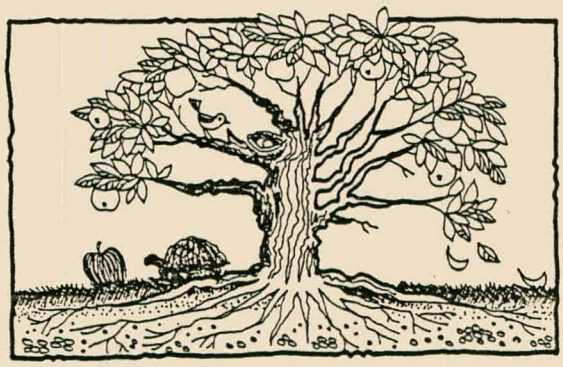
"...flies feed from decomposed, dead animal matter" (C = 2).

"...everything on earth has to die and decay" (C=2).

"I love flies because they are also nature; some people think they are of no value at all" (V = 2)

"Nothing should go to waste in the ecosystem" (C = 2).

6.2.1.7 THE ROLE OF TREES



Any indication that the respondent recognizes the important role that trees play in any ecosystem, and expressions of admiration, concern and respect for the role of trees were regarded as model responses in the cognitive and affective categories respectively.

On average the white respondents' scores in both categories were considerably higher than those of the black respondents. A substantial number of black respondents referred to the fruit borne by the tree as a possible source of food (C = 1). Another feature was the marked difference between the C - and V - averages, the C - average being considerably higher.

Some examples of actual responses (with the points scored in the respective categories) were:

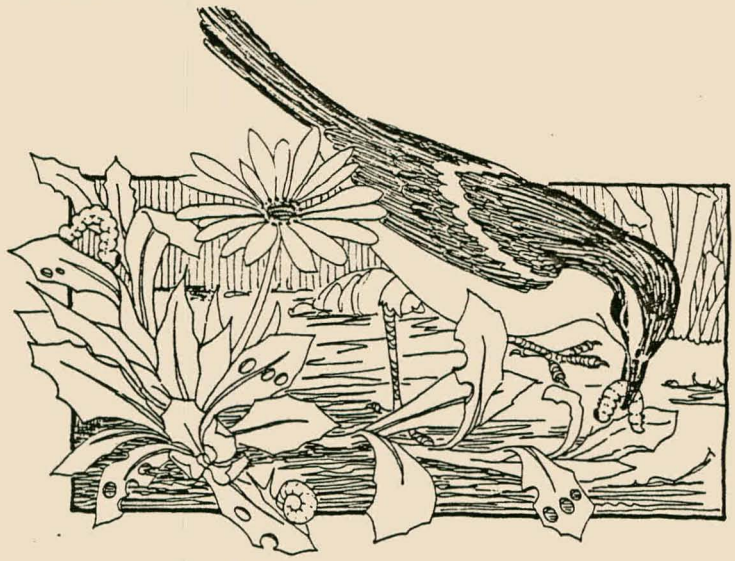
"Important to have trees - fruit, shade, good soil and people can breathe. No trees, no breath - die. And habitats for animals" (C = 3)

"Thankful to God for creating a tree" (V = 3)

"Tortoise and bird using the tree as a home..." (C = 2)

"What will happen to the animals if we destroy trees?" (V = 2)

6.2.1.8 FOOD RELATIONSHIPS



Recognition of the nutritional relationships was required to score three points in the cognitions category, while responses expressing understanding and respect for and/or wonderment at interdependency among living organisms earned three points in the affective category.

This item prompted satisfactory responses especially from white participants, whose average for cognitions was significantly higher than that of the black group (s^2

=0,000). The average for values was likewise substantially higher for white respondents. While only 7,2% of white respondents scored 0 in the cognitions category, the corresponding figure for the black respondents was 22,1%. It is noteworthy that while the majority of white respondents referred to some aspects of the food chain being illustrated, a considerable number of black respondents focussed on the bird finding something to eat for itself or for its young.

Some of the actual responses to this item were:

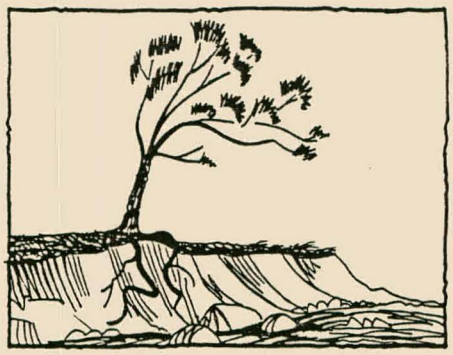
"Life cycle, worms eat the grass, and bird eats the worm"(C = 3)

"A bird getting something to eat for its young (C = 1)

"Wonderful - every little animal has its purpose in nature"(V = 3)

"Happy because bird has food"(V = 1)

6.2.1.9 SOIL EROSION



To qualify for full marks in the cognitions category, respondents had to indicate recognition of erosion as a result of human mismanagement. In the values category, respondents were expected to express strong concern or even anger and aversion toward the causes of erosion.

This concept was generally not well recognized, and a large percentage of invalid responses was recorded (71,7% for C, 76,8% for V). This led to a correspondingly low average for the affective category, although a number of black respondents expressed concern for the tree that is about to fall over.

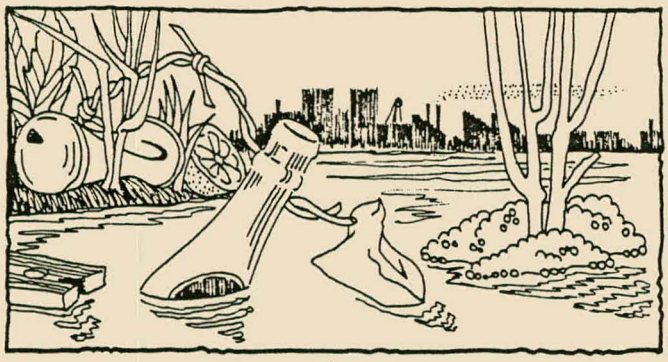
Among the white respondents, 22,0% recognized the concept, but only 17,7% expressed concern or apprehension about erosion or its causes. Some examples of actual responses are the following:

"Erosion has taken place as a result of human actions" (C = 3).

"Tree about to fall, as its roots are not in the ground" (C = 1).

"We must care for our soil; we must plant to stop soil erosion, must not burn" (V = 3).
"Sad" (V = 1)

6.2.1.10 POLLUTION



The anticipated ideal response in the cognitive category was mentioning pollution, **together with the human role and some harmful effects** of pollution. For the affective category, respondents were expected to express strong concern for the cause and effects of pollution or for aspects of nature that may be harmed by pollution.

The average scores in both categories of this item were substantially higher than for most of the other items. Only 16% of the responses in the cognitions category could not be scored. This percentage was made up mainly by black respondents focussing on the water and its possible uses such as drinking, cooking and washing. Objects floating in the water were also referred to (empty bottle that can be exchanged; orange can be eaten; tin might contain jam). A total of only 2,8% of the black respondents mentioned the term **pollution** in their responses, and this group was apparently more concerned specifically about the water being unfit for human use than the more general effects of pollution.

Another feature of this item that needs mentioning, is the (mainly white) respondents' strong expressions of concern and aversion. The mean V mark was ranked first as a result of this.

Examples of some actual responses are listed below.

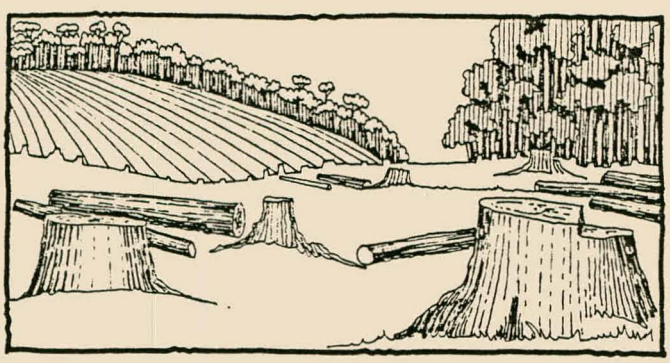
"People pollute and destroy the world" (C = 3)

"Sad that people are destroying the world" (C = 2; V = 2)

"...people are littering"(C = 1)

"Disgusting"; "Hate it" (V = 1)

6.2.1.11 DEFORESTATION



The ideal cognitive response for this concept was recognition of the concept of deforestation **and its possible effects.** In the affective category respondents were expected to express strong concern for the conservation, or the important role of forests.

The group averages for the C and V categories were ranked first and second respectively, indicating a generally positive response. One noteworthy feature was a tendency among black respondents to focus on the economic aspects, such as possible uses of wood for building, furniture, and firewood. Mainly as a result of

this, relatively few black respondents (10%) expressed any feelings about forests being destroyed. In contrast, the emotional reactions of the white respondents were generally strong and positive; only one other concept (pollution) prompted stronger emotional reaction.

A few examples of actual responses to this item are listed.

"When cutting down trees it kills us as well, because trees make oxygen"(C = 3)

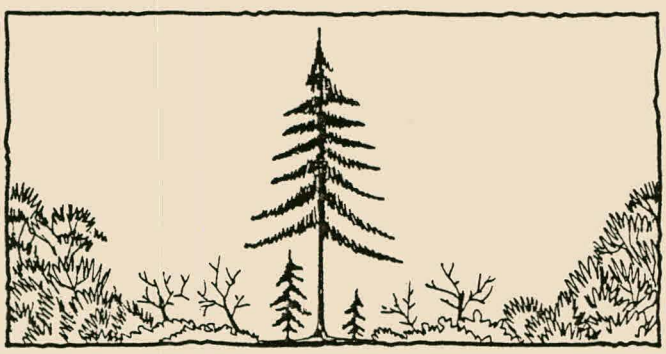
"A forest being cut down for the wood"(C = 2)

"Where carpenters...get wood to make furniture"(C = 1)

"...stop building and start preserving"(V = 3)

"People have ruined the landscape"; "...trees are becoming less" (V = 1)

6.2.1.12 PLANT INVADERS



The model response to this item is one recognising the threat posed by invader plants (cognitive) and expressing strong concern for indigenous vegetation, or suggesting some action to be taken to solve the problem (affective).

Only 3,9% of the whole group recognised the concept from the illustration, and only one of these was a black respondent. This led to averages for both C and V being ranked the lowest.

The majority of black respondents focussed on the tree and aspects like its beauty, possible uses (furniture, firewood) and a number were reminded of Christmas. These respondents therefore mainly expressed concern for the tree, and this was the only item where none of the black respondents scored any points in the affective category.

The following are representative of actual responses considered for scoring:

"Invaders take over our natural vegetation"(C = 3)

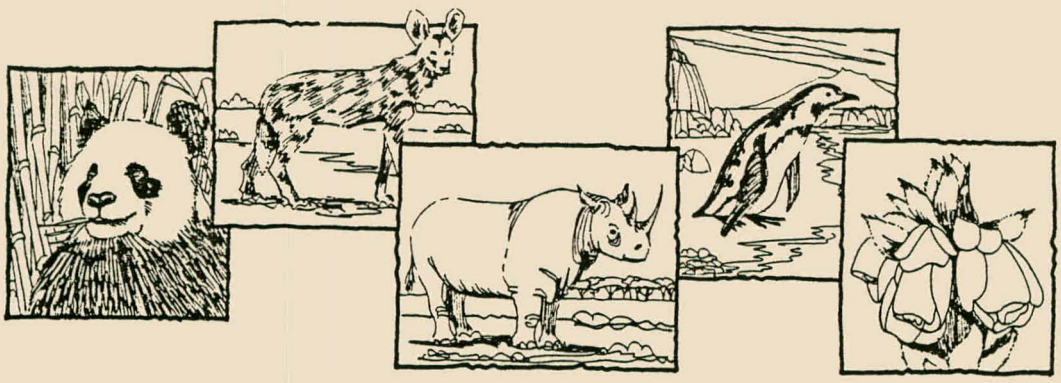
"We have too many exotic trees"(C = 2)

"A veld where plants are dying"(C = 1)

"...cross that we did not take care of our natural vegetation"(V = 2)

"Should plant more indigenous trees"(V = 1)

6.2.1.13 ENDANGERED WILDLIFE SPECIES



It was expected that respondents would recognize the concept of endangered species from the illustrations, mention the human causes and express concern and apprehension.

Only 20% of the total number of respondents recognised the concept. No black respondents are included in this figure. In fact, only 7 black respondents expressed concern for the species ("...must care for plants and animals"). In the cognitions section, the majority of black respondents focussed attention on the individual animals. Responses ranged from being purely descriptive, to aspects such as danger to humans, and the beauty of animals and plants.

The affective category scored a relatively high average (ranked fourth) since those recognising the concept expressed strong feelings about endangered species. Some of these responses are listed.

"Man is to blame for this happening; now we must take steps to prevent it" (V = 3)

"Those left must be protected"(V = 2)

"There should be more game parks and nature reserves"(V = 2)

6.2.2 THE ACTIVITY COMPONENT (SECTION C OF THE QUESTIONNAIRE)

A total mark for this section makes up the third model component and is essential to the breakdown into the four orientation categories described earlier.

The results of this section were probably not representative of the true measure to which the participants were involved in the natural environment and conservation. This was especially evident in the black group. The mean for this model component for the black respondents as a group was disproportionately high, and there appeared to be no positive correlation with the other section of the questionnaire. It seems illogical that this group could be regarded as highly involved in these matters as the results indicate, especially as this is not reflected by the relatively low means for the other model components. It appears as if the black respondents may have misinterpreted the instructions for this section, and marked all the "right" answers.

6.2.3 PROCESSING AND ANALYSIS OF RESULTS

Chi-square analyses were performed on all variables as a matter of course. However, these were often not valid as the cells were too small.
The coded results were processed by means of SPSS, a statistical computer programme. Frequency tables of the various codes allocated for each item in the questionnaire were produced. The following pre-test scores were computed for each respondent:

(1) **C-score**: The total cognitions score obtained by adding up the codes of the responses to the first question accompanying each of the thirteen illustrations, i.e. "What does it tell you?" **This score** (with a maximum of 39) **was regarded as representative of a respondent's knowledge of the concepts and issues depicted.**

(2) **V-score**: The total values score obtained by adding up the codes of the responses to the second question accompanying each of the thirteen illustrations, i.e. "How do you feel about it?" **This score** (with a

maximum of 39) **was considered representative of a respondent's values (feelings) toward the concepts and issues depicted.**

(3) **A-score**: The total activity score obtained by adding up the the codes of Section C of the questionnaire. This score was regarded as representative of a respondent's

- involvement in conservation actions;
- finding out and learning about the natural environment;
- general behaviour towards wildlife.

The maximum for this section was 36.

These three scores were used to represent the three model components of the evaluation model described earlier (see chapter 5, par 5.2.1).

6.2.3.1 Frequencies: Cognitions and Values scores

The frequencies of the cognitions and values scores for each of the illustrations are given in Appendix B-4(a). The mean scores for both cognitions and values per concept are represented graphically in fig. 6.1

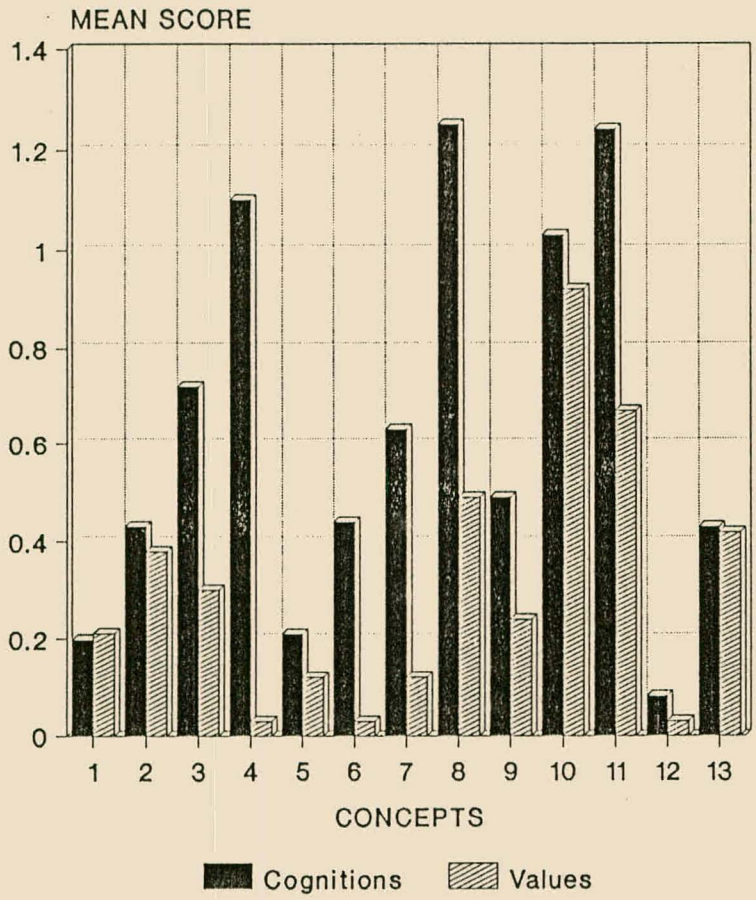


Figure 6.1

Graphic representation of mean scores for cognitions and values per concept.

(Key: 1 = Soil; 2 = Water; 3 = Drought; 4 = Dependency; 5 = Adaptations; 6 = Decomposers; 7 = Role of Trees; 8 = Food Chains; 9 = Soil Erosion; 10 = Pollution; 11 = Deforestation; 12 = Invader Plants; 13 = Endangered Species).

The following trends are most evident from these figures:

(i) a generally low percentage of maximum (3) codes;

(ii) the wide range of mean scores per concept, ranging from 0,083 (Invaders) to 1,254 (Food Chains) in the cognitions category, and from 0,033 (Invaders) to 0,920 (Pollution) in the values category.

(iii) with one exception, the mean score for cognitions is higher than that for values for every concept.

The low percentages of 2- or 3-codes were probably because the standard of the coding of the responses was relatively high, and the scoring principles were applied consistently.

From the wide range of mean scores per concept it is evident that the respondents did not have the same level of awareness or perception about each of the concepts. This points to the potential of the instrument in diagnosing deficiencies or learning needs in the knowledge or values of pupils.

The third tendency mentioned above is to be expected, as **feelings (statements of affect) will generally not be expressed in the absence of the necessary knowledge, thus accounting for the low number of high quality affective responses in the pre-test (prior to the sensitization of the respondents)**(see chapter three, p. 33). A further reason could be the fact that pupils are not often subjected to environmental values education, resulting in a possible absence of positive value systems. It may also be that pupils are not used to expressing their feelings, since opportunities to do so seem to be rare in the course of formal education.

6.2.3.2 Comparison of different schools

The sum of the **cognitions** and **values** scores that every respondent obtained for each of the thirteen concepts, called the "total perceptions scores", was used in this analysis. The means of these scores per concept are given in Appendix B-4(b) for each of the eleven participating schools.

The marked variation in mean scores obtained by the respective schools may point to the usefulness of the instrument in identifying the learning needs of a particular group. Likewise, the learning needs of individual pupils can be identified if the results of all the members of a class are examined.

The concepts for which most of the schools obtained their top three mean scores are *deforestation, pollution* and *food chains.* A notable exception is *water* for which schools nos. 4 and 8 (the two black schools) obtained their top mean scores, which are significantly higher than the generally low means of the rest of the schools for this concept. For *soil*, another natural resource, the same tendency is evident, but to

a lesser degree. On the other hand, the same two schools had relatively low means for *pollution* where the other schools obtained relatively high mean scores.

Where the means of *all* of the schools are low, as for *plant invaders*, either a general deficiency is disclosed, or the representation of the concept by the illustration could be suspect.

6.2.3.3 Analysis on the basis of other variables

Crosstabulations between variables such as sex, language groups, place of residence and ethnic group and the various scores indicated marked differences. The mean scores for the respective groups are shown in Table 6.2 below.

		MEAN SCORES			
		C	V	A	N
SEX	Male	8,63	4,65	22,33	215
	Female	7,98	4,27	20,92	396
PLACE OF RESIDENCE	Village	9,02	5,10	21,78	220
	Farm	9,89	6,19	19,69	65
	City	7,38	3,57	20,97	326
LANGUAGE	Afrikaans	9,06	5,29	22,10	318
	English	9,33	5,21	22,6	107
	Other	6,27	2,42	19,60	186
ETHNIC GROUP	White	9,36	5,40	22,70	374
	Coloured	7,39	4,21	18,90	56
	Black	6,23	2,38	19,6	181

Table 6.2:

Means of C -, V -, and A - scores for different groups of respondents

Unfortunately the distribution of the respondents into the various groups is not proportional.

The following is evident from the above:

- city-dwelling respondents gained relatively low mean C and V scores;
- the black group and the language group named "other" (these were mostly Xhosa-speaking) had low means for C, V and A;
- all three mean scores were slightly lower for the female respondents;
- there is no marked difference between the mean scores of the English and Afrikaans respondents.

6.2.4 FOUR CATEGORIES OF ORIENTATION TOWARDS THE NATURAL ENVIRONMENT AND CONSERVATION

The C-, V- and A-scores of each of the respondents were labelled either "high" or "low" in order to categorize respondents in the four categories of the model described earlier. The means for each of the scores used to differentiate between high and low scores were:

C-score : 8,3
V-score : 4,4
A-score : 21,4

Figure 6.3 shows the categorization on the basis of the pre-test results.

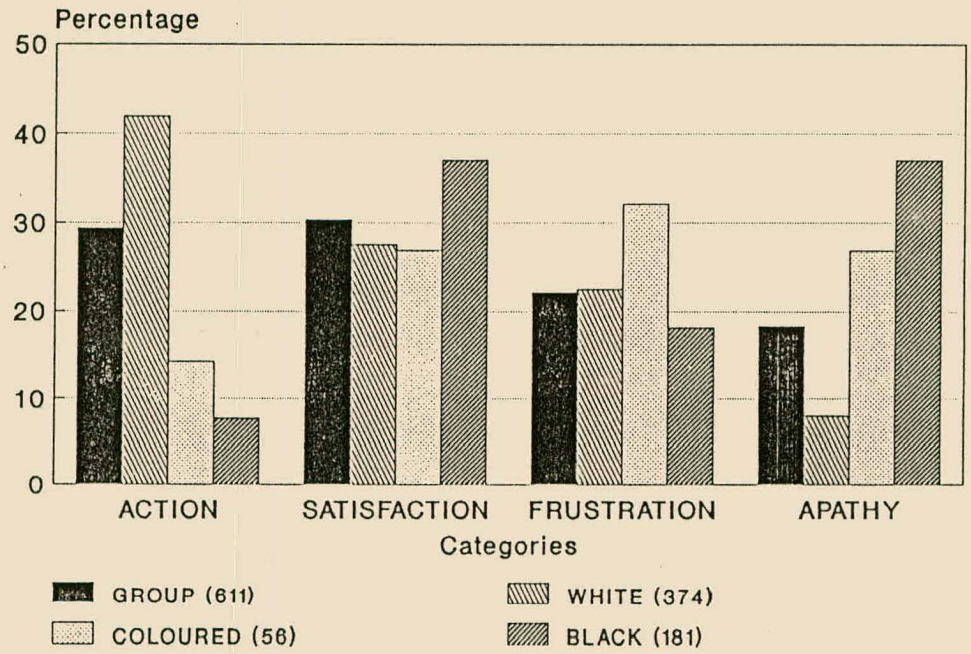


Figure 6.3:

Graphic representation of the different orientations of the respondents toward the natural environment

The differences in the categorization of the various groups are especially evident in the ACTION and APATHY categories. These differences can be ascribed to the relatively low mean scores for cognitions and values of the black group.

The relatively high percentage of black respondents falling into the SATISFACTION category may be ascribed to the disproportionately high average of the black respondents in the activities section. A possible weakness of the Actvities component has been discussed earlier. It is therefore desirable to investigate further the validity of this aspect of the instrument for the black group.

For diagnostic purposes in the classroom however, the potential value of the evaluation model has been demonstrated. It is apparent from the distribution that the activity component must have tested relatively high (shown by the relatively high occurrence of SATISFACTION respondents). It is also clear that a further increase

in this component, as well as increases in the other two model component means would reduce the number of respondents classified in the FRUSTRATION and APATHY categories.

The categorization of the white group shows the expected close correspondence to the distribution of a group of standard eight pupils in the four categories found in an earlier investigation (Schreuder, 1987).

6.3 THE APPLICATION OF THE INSTRUMENT AND THE EVALUATION MODEL IN A QUASI- EXPERIMENTAL DESIGN

Because of unforeseen circumstances only eight of the original schools could take part in this excercise. These were all white schools, and the responses of 328 pupils from these schools who completed both pre- and post-questionnaires were used in this exercise.

The rationale was first to establish whether the instrument could identify improvement of the three measurable variables in pupils, and second whether more substantial improvements in the scores of the experimental group as a result of a planned intervention could be identified when compared to those of the control group. Many of the variables such as social circumstances, ability and initial awareness that could influence the scores were controlled to a certain extent by involving two more or less comparable classes from the same school in the experiment - one class as part of the experimental and the other as part of the control group.

Teachers involved with the experimental group were requested to assimilate a selected number of educational activities from a conservation education resource package ("We Care!" 1988) into the teaching of the ecology section of the standard six syllabus. The control group, taught by other teachers, were not to be exposed to this programme.

There was no control over the selection of the two groups per school in order to ensure comparability, as this might have caused major disruptions in the school programme. For the same reason, there was no control over the actual

implementation of the education programme, although participating teachers were briefed on effective strategies and teaching approaches in this regard.

For any claim that differences in the improvements recorded in two groups are valid, the comparability of the test groups is a prerequisite.

6.3.1 COMPARABILITY OF CONTROL AND EXPERIMENTAL GROUPS

A multivariate statistical analysis (Hotelling's T-squared test) was done on the means of the pre-test scores to determine the comparability of the two groups prior to intervention (cf. Johnson and Wichern 1988:221-231). These calculations are included as Appendix B-5(a).

The mean scores and standard deviations (in brackets), as well as student t-values for individual variables appear in table 6.5 below. (See Appendix B-5(a)).

	N	C-SCORE	V-SCORE	A-SCORE
CONTROL GROUP	143	9,36 (3,43)	5,50 (2,70)	22,43 (6,55)
EXPERIMENTAL GROUP	185	9,28 (3,78)	5,37 (3,14)	22,36 (5,63)
T (326 DF) P-Value		0,20 p=0,83	0,39 p=0,69	0,11 p=0,92

Table 6.5:

Means and standard deviations (in parentheses) of C -, V - and A - scores in pre-test, control and experimental groups.

The Hotelling T-squared F-test indicates that **there was no significant difference between the three mean scores of the control and experimental groups prior to intervention** (F = 0,054, P = 0,98). These analyses strongly support the assumption

that the two groups can be compared regarding the aspects assessed by the instrument. (Appendix B-5(a)).

The assumptions underlying these analyses are very likely to be satisfied. The large sample sizes and the fact that the final scores are composed of sums of the basic measurements will ensure the marginal normality by the central limit theorem of statistics (Loubser 1990: pers. comm.).

6.3.2 GENERAL IMPROVEMENT IN SCORES

In order to confirm the anticipated general improvement in the respective measured aspects of the experimental group as opposed to that of the control group, the pre-post test results of the two groups were compared regarding

- mean scores of the three test components;
- the number of high quality responses;
- the number of responses where an increase was recorded;
- the four orientation categories for the natural environment and conservation.

6.3.2.1 Mean scores of the three test components

In this exercise the three mean scores of the two groups (post-tests) were compared as well as the mean differences between pre- and post-scores. Both tests (F- and t-tests) to investigate the significance of the differences in mean scores of the three test components were carried out. The assumptions underlying these can be justified by the same arguments as before.

The application of Hotelling's T-squared test for the comparison of experimental versus control groups for the post-test scores produces an F-value of 11,03 (DF = 3 and 324 respectively) with significance value of P = 0,000 (See Appendix B-5(a)). This indicates a highly significant difference. To resolve the question as to which of the three variables is responsible for this indication, the method of Bonferroni's multiple comparison is applied to each individual variable (Johnson and Wichern *op. cit.*: 188-189). This means that the hypothesis of equal group means is tested by applying a student t-test to each of the three variables, but at the 0,05 – 3= 0,017

level. This guarantees an overall level of significance of 5%. The results of these individual comparisons for the components cognitions (C), values (V) and activities (A) are presented in table 6.6.

	N	C-SCORE	V-SCORE	A-SCORE
CONTROL GROUP	143	10,14 (3,56)	5,98 (2,58)	22,23 (6,06)
EXPERIMENTAL GROUP	185	12,39 (4,52)	8,13 (3,90)	23,03 (6,41)
Student t P-Value		4,90 0,000	5,70 0,000	1,14 0,254

Table 6.6

Means, standard deviations (in parentheses) and student t-tests in the comparison of mean post-scores (see App. B-5(a))

The nil-hypothesis is therefore not supported for the differences in the mean scores of cognitions and values; in the case of activities however, no significant differences in the mean scores of the two groups was found.

A final analysis was made **of the differences between individual pre- and post-scores for the three components for each group.** These differences were labelled Diff-C, Diff-V and Diff-A respectively. As before, these differences were subjected to the Hotelling T-squared test to test the nil-hypothesis **that there are no significant differences between the improvements in the mean scores of the two test groups.** The outcome of the multivariate test is an F-statistic of 18,20 upon 3 and 324 degrees of freedom, with a P-value of 0,00 (Appendix B-5(a)) This indicates highly significant mean differences and as before, individual student t-tests were performed on each different variable separately. These results are summarized in table 6.7.

	N	Diff-C	Diff-V	Diff-A
CONTROL GROUP	143	0,78 (3,22)	0,48 (2,77)	-0,20 (6,54)
EXPERIMENTAL GROUP	185	3,11 (3,80)	2,76 (3,16)	0,66 (5,77)
Student t P-Value		5,90 0,000	6,84 0,000	1,27 0,203

Table 6.7.

Means, standard deviations (in parentheses) and student t-tests in the comparison of mean improvements in scores of the two test groups (see App.B-5(a))

The individual t-tests indicate significant differences between the test groups regarding the improvements in both cognition and values mean scores, but not in the activity mean score.

These results seem to support the assumption that the instrument can be used not only for differentiating between individual pupils regarding differences in cognitive and affective aspects, but also for identifying the influence of a learning programme on these aspects. For the activities component, the results were disappointing, although expected. This could be ascribed to inherent weaknesses in either the instrument or in the teaching programme.

6.3.2.2 Number of high quality responses

An examination of the scoring scheme (Appendix B-3) confirms that a response receiving a 1-score in the cognitions category is not necessarily an indication of awareness of the concept or issue depicted. A mere description of an aspect of the illustration which was considered a step in the direction of recognition of the concept was coded 1. However, a 2- or 3-score required a substantial degree of recognition of the concept represented. It is considered logical that sensitisation of

the experimental group by the planned intervention should result in an increased number of higher quality responses (scored 2 or 3). The frequencies of the various **cognitive** scores were subsequently analysed with the intention of illustrating the effect of intervention in this way.

A similar tendency was expected for the values component, albeit to a lesser degree. Credit in this category required some recognition of the **concept** as well, because the coder had to be convinced that any emotion expressed was towards the concept depicted in the item concerned. The relative value of a 1-score in the values category was therefore higher than that in the cognitions category.

Figure 6.8 represents graphically the changes in the frequencies of the various scores of the pre- and post-tests for cognitions and values for both groups. (The table in Appendix B-4(c)) shows the actual frequencies and the percentages of the various cognitions and values codes (0 - 3) respectively in the pre- and post-tests for the individual concepts for both groups).

In the graphical representation the 2- and 3-scores are grouped as both were regarded as high quality responses.

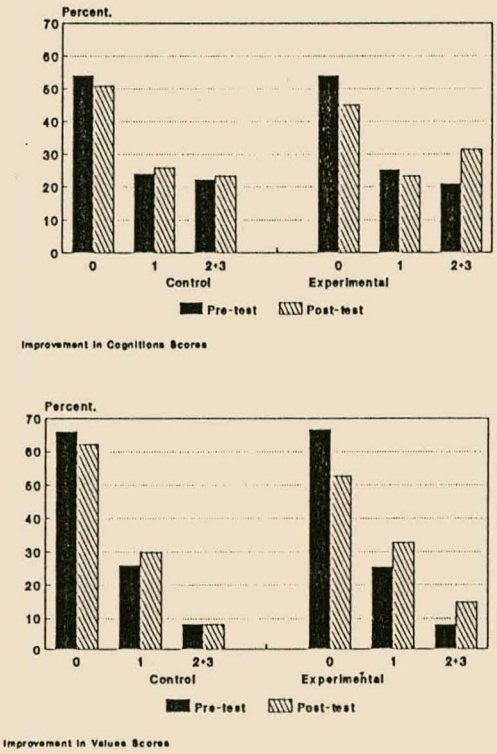


Figure 6.8

Frequencies of scores in cognitions and values categories for control and experimental groups: pre- versus post-tests

A comparison of the frequencies of the various codes allocated in the pre-test of the control and experimental groups shows marked similarities. This further confirms the initial comparability of the two groups.

A comparison of the shifts between pre- and post-frequencies of the various scores of the two groups reveals the following:

(i) Cognitions category

- a greater decrease (16,5%) in the number of O-scores (responses receiving no credit) in the experimental group (from 53,9% to 45,0%) as compared to the decrease of only 5,9% in the control group (from 54,0% to 50,8%);

- an increase in the frequency of 1-scores in the control group by 8,4%, but a corresponding decrease of 7,5% in the experimental group indicating a lower frequency of low-quality responses in the post-test in the latter group;
- In the control group the number of 2- and 3-scores showed an increase of 5,9%. The corresponding shift in the experimental group, however, was an increase of 52,0%.

(ii) Values category

- a decrease of 21,1% in 0-scores of the experimental group as opposed to the 5,8% of the control group;
- both groups showed an increase in 1-scores, that of the experimental group being 28% as opposed to the 14,7% of the control group;
- the substantial increase of 88,5% (from 7,8% to 14,7%) in 2- and 3-codes recorded in the experimental group as compared to no change recorded in the control group is the most significant observation from the data in this category.

This analysis illustrates a substantial improvement in the experimental group, while a similar trend is not evident in the control group, especially for the higher quality responses.

6.3.2.3 Number of responses with improved cognitions and values scores

In addition to the average change of the various scores from pre- to post-tests, the **difference between the individual scores recorded in the post- and pre-tests** was computed for each item. These differences were used as the basis for a further comparison between the two groups. The table in Appendix B-4(d) contains the frequencies of each of these computed differences ranging from -3 to +3 for all the concepts compared for the control and experimental groups. Table 6.9(a) below shows the totals of these frequencies for cognitions and table 6.9(b) the same for values. The respective scores for all the concepts were taken into account for both these analyses.

The frequencies in these two tables are expressed as percentages of the total number of responses.

		TOTAL NUMBER	△- SCORES						
		OF RESPONSES	-3	-2	-1	0	1	2	3
CONTROL GROUP	N 143	1 859	5	53	224	1 253	205	106	13
	% 100		0.3	2.9	12.0	67.4	11.0	5.7	0.7
EXPERIMENTAL GROUP	N 185	2 405	6	66	214	1 496	354	221	48
	% 100		0.3	2.7	8.9	62.2	14.7	9.2	2.0

Table 6.9(a)

Frequencies of individual △scores (in range -3 to +3) for all responses in cognitions category : control and experimental groups

		TOTAL NUMBER	△- SCORES						
		OF RESPONSES	-3	-2	-1	0	1	2	3
CONTROL GROUP	N 143	1 859	1	25	242	1 281	256	54	0
	% 100		0.1	1.3	13.0	68.9	13.8	2.9	0
EXPERIMENTAL GROUP	N 185	2 405	0	24	218	1 521	511	127	4
	% 100		0	1.0	9.1	63.2	21.2	5.3	0.2

Table 6.9(b)

Frequencies of individual △scores (in range -3 to +3) for all responses in values category : control and experimental groups

In both groups more than 60% of the responses scored the same in the pre- and post-tests. This was the case in both the cognitions and values categories.

However, the relatively high percentage of experimental group responses with an increased score in the values category (26,7% = 21,2% +5,3% + 0,2%) as opposed to the 16,7% (13,8% + 2,9%) of the control group is apparent. The number of increased scores for cognitions in the experimental group (25,9% = 14,7% + 9,2% + 2,0%) is also higher than that of the control group (17,4% = 11,0% + 5,7% + 0,7%).

A decrease was recorded in a total of 15,2% (0,3% + 2,9% + 12,0%) of the control group scores, and in 11,9% (8,9% + 2,7% + 0,3%) of the experimental group scores for cognitions. The corresponding percentages of decreased scores in the values category was 14,4% (0,1% + 1,3% + 13,0%) for the control group and 10,1% (1,0% + 9,1%) for the experimental group.

6.3.2.4 Four categories of orientation toward the natural environment and conservation

Adams, Newgard and Thomas (1986:266) suggest that this type of analysis and the four-dimensional model might successfully be applied "as a pre- and post-test instrument to school and community education programs designed to address cognitive and affective positions of students ...".

The three model components (i.e. **cognitions**, **values** and **activity**) were therefore applied in the breakdown into the four orientation categories, and the results of the pre-test and those of the post-test were compared for both the experimental groups and the control groups. The means for the respective components were 9,3 for the cognitive component, 5,4 for the values component and 22,4 for the activities component, being the pre-test mean scores for the schools participating in the experiment.

Although the responses were matched for the pre- and post-tests, no individual changes were considered for this analysis. Shifts among the orientations therefore represent group changes.

The improvements in the respective component scores as a result of an intervention are expected to be reflected in a shift away from the apathy, frustration and satisfaction categories toward the action category. The graphic representations (fig. 6.10 (a), (b)) illustrate the shifts for the two test groups.

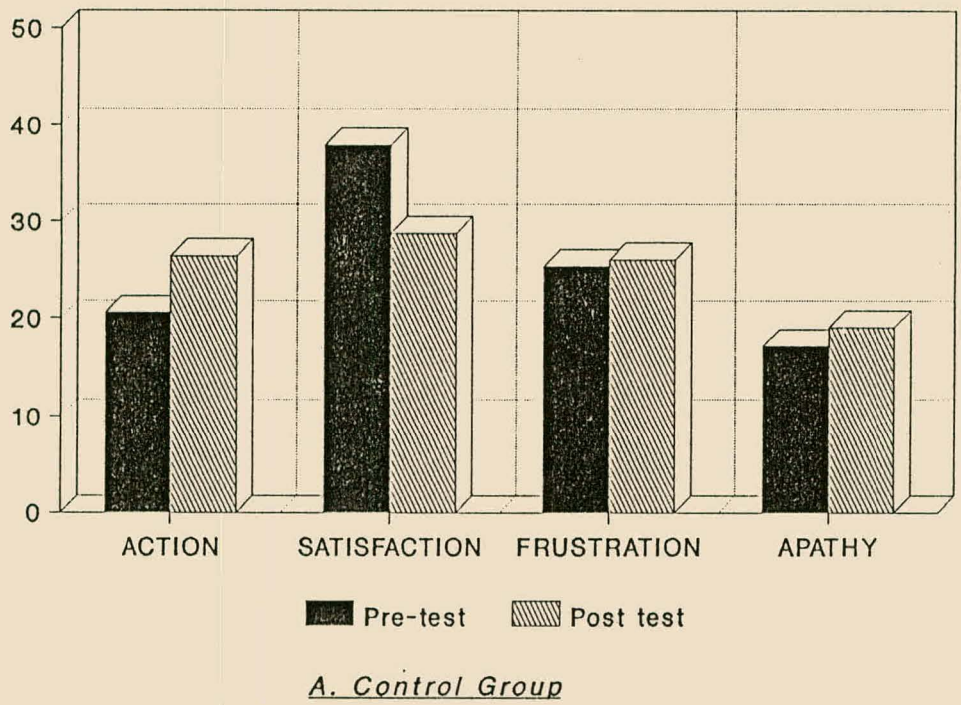
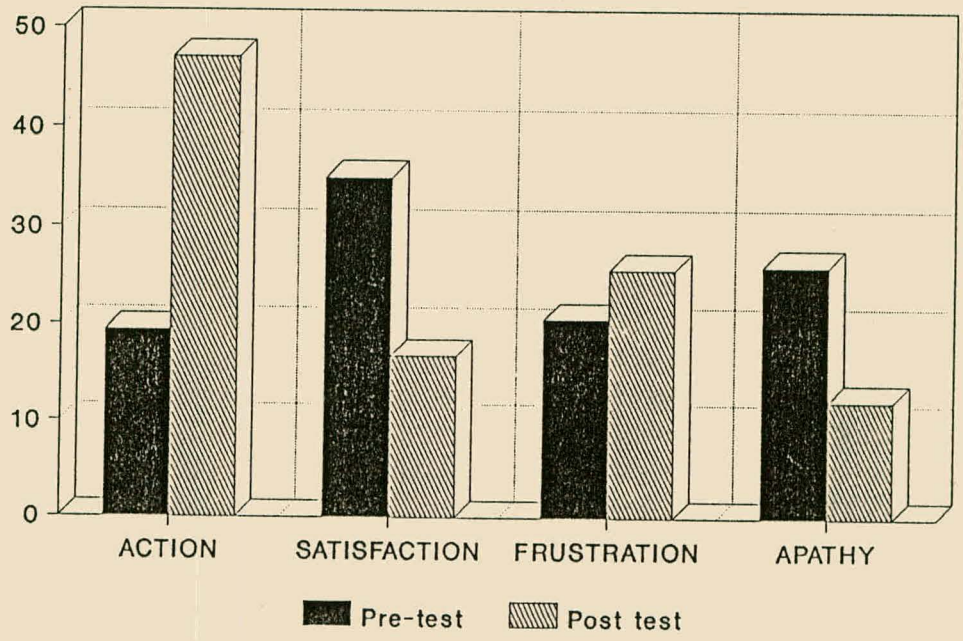


Figure 6.10(a)

Comparison of orientation categories of the control group, before and after intervention



B. Experimental Group

Figure 6.10(b)

Comparison of orientation categories of the experimental group, before and after intervention

These figures were used in a statistical analysis to determine whether the contrasts in the categorization of the two groups before and after intervention were significant or not. The programme used was designed for the analysis of ordinal data . The following results were obtained:

1. **The contrast between Orientation (Control) and Orientation (Experimental) before intervention had a standardized value of 1,2 which is less than 1,96 and therefore strongly supportive of the nil-hypothesis, i.e. that there was no initial difference between the two groups.**
2. **The contrast between Orientation (Control) and Orientation (Experimental) after intervention had a standardized value of 2,9 which is more than 1,96. This represents strong evidence against the nil-hypothesis, i.e. that there is no difference between the two test groups after intervention (App. B-5(b) p10).**

There is therefore further statistical evidence that the instrument and the model identified differences between the two test groups as a result of the intervention.

An interpretation of these findings leads to the identification of interesting trends which could possibly be used in the classroom. In the ACTION category, the experimental group showed an increase of 27,5% as opposed to a corresponding increase in the control group of 6,29%. This must be regarded as significant, as this orientation type is the ideal in terms of its description. The increase in the experimental group must be associated with the intervention, especially when compared to the relatively small increase shown by the control group.

The SATISFACTION category is regarded as similar to the APATHY category, and described to be analogous to an "I don't know, so I don't care" orientation (Adams *et al.* 1986:266). In both the groups a decrease in the satisfaction category was identified, although this was much more substantial in the experimental group (-18,37% of experimental group, compared to -9,09% of the control group). In a classroom situation, the attitudes and knowledge of the pupils in this category should specifically be addressed; it would therefore appear that in this respect, the enriched teaching programme to which the experimental group was exposed was more effective than the normal programme followed with the control group.

The FRUSTRATION category characterizes pupils with positive cognitions or values, but low involvement in the issues in question. The increase in the number of pupils in this category (+4,86% of the experimental, and +0,69% of the control group) can be seen as the result of the fact that a number of pupils showed improvement with regard to either cognitions or values without the accompanying improvement in the activities component.

Ideally it would be expected that most of the respondents in this category would have moved away from the APATHY category. This was however not the case; the best explanation for this can be found in the **inconsistency in the responses of the activities section** in the questionnaire. It would appear that a significant number of respondents obtained an unrealistic mark for this section. This has been discussed with regard to the black group, but it appeared to be a more universal problem. An actual decrease in the totals for this section was found in 15,9% of the whole group,

accounting for the phenomenon that the shift towards the frustration category took place not only from the apathy category as expected, but to a lesser degree also from other categories.

In the APATHY category, there was a significant difference between the two groups. While there was a substantial decrease in the experimental group (-14,05%) there was an **increase** of 2,09% in the control group. Although the decrease shown by the experimental group is to be expected as an increase in any one of the model component scores will result in a shift to one of the other categories, the increase shown by the control group is more difficult to explain.

It is suspected that a significant number of control participants did not take the completion of the post-test questionnaire seriously. Most of the participants in the experimental group were aware of the fact that they had the opportunity to improve on their initial performance, while this was not the case with the control group. There can be little doubt that this influenced the results.

A significant conclusion is that this model is suited to reflect improvement, and to identify various learning needs. Further refinement could increase the potential of this technique to improve teaching, and the realization of some of the key objectives of environmental education.

6.4 CONCLUSION

The overall results of the investigation in which the measuring device was used supported the anticipated potential of the instrument and the evaluation model for classroom application.

6.4.1 Despite some apprehension that the unconventional nature of the measuring instrument would make the interpretation and analysis of the results difficult, it was found that significant trends could readily be identified. These mainly concern the differentiation between respondents due to different levels of awareness of the natural environment and conservation and different values held toward it. It was also proved statistically that meaningful improvements

to these aspects could be identified after a planned learning experience had taken place.

6.4.2 Although some of the normal statistical analyses could not be used on the results (e.g. chi-square analyses), other programmes such as a multi-variate analysis (Hotelling's T-squared Test) combined with Bonferroni's multiple comparison statistically proved the comparability of the two tests groups before intervention, and substantial differences between the same groups after intervention. These differences could be ascribed to the intervention to which the experimental group was exposed.

6.4.3 One of the disappointing features of the investigation was already obvious in the pre-test results. This was an unmistakable weakness of the instrument manifested in the results of the section designed to assess the activities component, as these were not entirely reconcilable with the results of the other two components assessed by the instrument. This weakness was amplified in the results of the post-test. While improvements were identified for cognitions and values, these improvements were not reflected by the results of the activities section. It is suspected that the structured responses of this section may have been the main problem.

6.4.4 The four-dimensional evaluation model proved to have sufficient potential to warrant further development. The biggest advantage of this model was the graphic illustration of learning needs, and the demonstration of shifts away from less desirable orientations toward the natural environment and conservation toward the more desirable orientation after intervention. The successful application of this model was shown to depend entirely on the reliability of the measurement of the model components. The shortcomings of the instrument in the assessment of the activities section were stressed.

In conclusion, it can be stated that according to the theoretical background expounded in the preceding chapters, and considering the main purpose of the evaluation technique, the measuring instrument and the evaluation model both show encouraging potential. Further development, particularly of the assessment technique, is essential, but the potential of this technique for furthering the general

objectives of environmental education in both formal and informal education can not be discounted.

6.5 REFERENCES

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Loubser, N. L., 1990. Personal Interview : January - March 1990.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

> In view of the well-nigh incredible proliferation of change in global society and in our technologies, the inhabitants of this planet must supplement and extend our understandings of the new environments that surround us.
> Harold G. Shane (1990)

7.1 GENERAL

The rationale of this study was based on a number of actualities which can be summarized as follows:

* Like the rest of the world, southern Africa is sorely in need of a new approach to formal education which will enable man to address problems and issues related to himself and the environment. Not only does South Africa experience many of the social and ecological ills characterizing Western societies, but to some extent also those characteristic of the less developed countries. The implications for education are evident, but at the same time they present education planners with unique challenges.

* Furthermore, a society in which the majority of people suffer the adverse effects of constitutional inequalities, where there are vast socio-economic differences and fundamental differences in world views is faced with a variety of educational demands and learning needs.

* The introduction of environmental education in local formal education systems seems inevitable, but whether practising teachers are prepared for

this is open to question. In the early stages where various curricula may have to be redeveloped and adapted to include the principles of environmental education, curriculum development and evaluation may come under close scrutiny. Aspects of evaluation that may well have to be fundamentally changed are context evaluation (the collection of information about target audience, social context and learning needs) and product evaluation (collecting information about educational outcomes).

The very nature of the goals of environmental education demand that current educational evaluation approaches be reviewed. These approaches are often aimed at assessment of cognitive outcome with a view to promoting pupils. Evaluation of other outcomes, especially on the affective level, may have to be given serious consideration, as such practice could be useful in informing decisions about curriculum processes and content.

The development of the evaluation instrument described is an effort to address some of the anticipated demands of curriculum evaluation. While the endeavour should be regarded as tentative and developmental, a number of conclusions can be drawn about the technique, the approach and the results. Furthermore, a number of aspects that could lead to further research have been identified. These conclusions and recommendations are discussed in the subsequent paragraphs.

7.2 CONCLUSIONS

7.2.1 THE APPROACH IN GENERAL

7.2.1.1 Possible limitations and usefulness of the instrument

Probably the most serious limitation of such an evaluation instrument is that its use may be based on the simplistic assumption that all educational outcome is measurable. This inherent liability may have negative effects on teaching if the instrument is used by teachers who are not thoroughly aware of this.

Another limitation is the difficulty encountered assessing aspects of the affective domain.

The value of the instrument lies in its capacity to generate information of remarkable quality that may be useful in curriculum development. Furthermore the instrument succeeded in differentiating among a large group of pupils with regard to the three variables, i.e. cognitions, affect and involvement regarding the natural environment and conservation.

When the instrument is used to generate information and not as a measuring device, the anticipated worth of this technique for improving teaching may to some extent overshadow these limitations.

7.2.1.2 The information collected

In retrospect it might be concluded that the quality of the information collected could be of great value in the process of curriculum planning and design. Qualitative information on aspects associated with environmental behaviour could be used to make certain inferences, particularly about

* possible learning needs among a group of pupils in respect of cognitions, and affective and conative aspects prior to a planned intervention;
* improvements observed in the abovementioned aspects after the intervening programme;
* certain basic trends in the variables among different ethnic groups that could possibly be related to learning experience, socio-cultural "background" or both.

7.2.1.3 "User-friendliness" of the instrument

Provided the prospective user is made aware of the limitations of the approach, and does not regard it as an alternative but as an additional means of evaluation, few problems are foreseen when the instrument is used for classroom purposes. This was one of the most important guidelines in the development of the instrument, and informal pilot testing involving student teachers after minimal training in its usage indicated sufficient potential. It must be added that a few problem areas were uncovered, especially concerning the interpretation of responses, but these are

relatively insignificant if the positive influence and potential is considered. Further development of this technique should however involve extensive field-testing, where teachers are more fully informed on the theoretical principles of the instrument, and are encouraged to design their own instruments based on these guidelines, but adapted to their needs.

7.2.2 ASPECTS OF THE QUESTIONNAIRE

7.2.2.1 The use of visual stimuli for eliciting responses

It was found that using line-drawings to depict issues and concepts related to the natural environment and conservation and to elicit responses proved rewarding for a number of reasons. The most important of these are the following:

* The stimulus is unbiased.

* The explicitness of the concept portrayed can be varied for better differentiation between responses.

* The quality of the information collected by the combination of visual stimuli and open responses is higher than that generated by similar instruments studied.

* Reading fatigue is minimized, allowing for a substantial number of concepts to be included in a single investigation.

It was, however, quite a challenge to portray certain issues and concepts. Examples of these were soil, water, drought, the dependence of living organisms on each other and on natural resources, and invasive plants. Certain aspects of this approach need further research, and will be discussed under the heading "Recommendations".

7.2.2.2 The response type

The technique of open responses (as opposed to structured multiple choice items) yielded valuable qualitative information on various aspects of pupil attitudes toward the natural environment. Some of this information was not altogether expected, for example the distinct trends that were identified in white and black pupils' attitudes toward the natural environment and conservation. This could be ascribed to the fact that respondents were not limited to a choice between preconceived alternatives, particularly for the affective responses, but were free to express own beliefs and feelings. The degree of honesty and openness perceived in responses was also not expected.

The interpretation of these responses, however, proved troublesome and time-consuming, and is probably the aspect that is subject to most criticism. Some of the perceived problem areas were those of allocating equivalent weights to responses to different items, and of maintaining objectivity in the coding process. For the latter, it was accepted that a certain measure of subjectivity is to be expected in many assessment procedures, and that this is not altogether unacceptable provided it is recognized in both the method and in the conclusions.

However, the effort of analyzing open responses may be worthwhile when judged agaist the quality of the information collected. It is hardly conceivable that structured responses would achieve results of similar quality, although it might be easier to analyze and statistically "prove" certain inferences.

Having listed all of these difficulties, it must be said in defence that if this technique is applied as recommended, i.e. to collect information either before or after a learning experience, it might not be necessary to weight or code the responses. Certain tendencies can be observed by merely categorizing the responses.

7.2.2.3 Evaluation of the "activities" component

There is reason to believe that this section of the questionnaire did not yield information of a similar quality compared to the other section. Possible reasons for this may be that the items included were not properly selected, and the choice of

structured type items. Black respondents in particular appeared to have **selected** the right answers. This may have been caused by a semantic problem, which led respondents to misinterpret the instructions. However, this is speculation and should be confirmed.

The inclusion of this type of item in a questionnaire based on illustrations coupled with open responses may have been an unfortunate decision as the results of the entire group for this section lost some credibility. This was confirmed by the statistical tests, which showed that this variable showed no significant influence on the overall results. Furthermore, the post-test results of this section were not reflected by the information collected during interviews with teachers, who in a number of instances reported increased involvement of pupils after the planned intervention.

7.2.2.4 The Four-Dimensional Model

Although the results of the investigation expressed in the four orientation categories of Newgard's model may have been adversely influenced by the outcome of the activities section of the questionnaire, the model showed potential for educational application. The worth of the model may lie in its expression of results in adequately defined categories, so that learning needs are graphically illustrated. The fact that it explicitly illustrates change in any of the model components, (this was confirmed statistically) and in such a way that it can be interpreted easily, further enhances the usefulness of the model.

A possible argument against the usability of this model may be the fact that it depends on the weighting or quantification of variables (cognitive, affective and conative aspects of behaviour). As was mentioned earlier, this is one area that should be approached with the necessary circumspection, and teachers not properly trained in this area should for obvious reasons not be encouraged to use the model.

7.3 RECOMMENDATIONS

7.3.1 GENERAL: ENVIRONMENTAL EDUCATION AND EVALUATION

Earlier it was mentioned that environmental education should not be "used" to revolutionise education in southern Africa, although its potential as a possible unifying factor should be fully exploited.

A more productive approach might be to identify specific subject areas where the principles of environmental education could be assimilated without revolutionising education systems. Initially, it may be more practical to use subject curricula such as biology and geography to serve as "footholds" from where an environmental education approach could be encouraged to diffuse through a number of other school disciplines. This has been termed the infusion approach (Stone 1990:44).

A number of recommendations about this process of formalizing environmental education became evident during this study.

First priority should be given to environmental education in teacher-training programmes, both in-servive and pre-service. In these programmes, particular attention should be given to the following aspects:

* the urgency, basic principles and main goals of environmental education and the possible opportunities that exist in every school discipline to contribute toward the attainment of these goals;

* suitable approaches to teaching, and relevant methods to attain the goals of environmental education, with special reference to the development in pupils of positive value systems toward the environment;

* the art of developing curricula for environmental education within the parameters of existing syllabuses for the different school disciplines, and the critical importance of formative evaluation in this process. This may have to include an understanding of the importance of additional evaluation strategies, and the theoretical principles and application of some of these.

Furthermore, cooperation among the various school disciplines should receive special attention so that whatever expertise and materials are available may be used.

An area that warrants thorough research is that of evaluation, especially context evaluation to enable curriculum developers at macro-level to take into account the particular needs of the target audience and the social context in which the learning is to take place. The development or adaptation of evaluation models to suit the needs of curriculum development for environmental education should enjoy high priority, and the development of suitable evaluation instruments for this purpose, especially those that can be applied by the teacher, is equally important.

The research described in this study was limited to pupil behaviour toward aspects of the natural environment. To serve more fully the goals of environmental education, this evaluation technique should be further developed and adapted to include aspects of the social environment. It may be possible to apply the same broad principles in this context, and it might serve to further enhance the possible utility of the technique for educational purposes.

7.3.2 RECOMMENDATIONS REGARDING THE EVALUATION TECHNIQUE DESCRIBED IN THIS THESIS

A number of problem areas have been described in previous paragraphs. All of these aspects require further research, as this study should be regarded as the first tentative stage of development of an evaluation technique.

7.3.2.1 The use of visual stimuli to elicit responses

The use of visual stimuli in eliciting both cognitive and affective responses was shown to have potential, but should be further refined. A number of practical problems, such as availability of suitable material to teachers and type of visual representation requires further investigation.

It may also be important to investigate aspects of black pupils' perceptions of visual material. Although the technique appears to have yielded satisfactory results among a black audience, it was not properly investigated beforehand.

Further research to investigate the relative suitability of line-drawings for this purpose as opposed to photographic material may likewise be necessary.

7.3.2.2 The use of open responses

The advantages of open responses have been discussed, particularly the quality of the information collected. The most valuable was the unexpected and often very useful information collected, which is excluded when using structured responses. Further development of the use of open responses in educational evaluation of this type is therefore warranted.

Certain problem areas have been identified, especially regarding the process of judgment and coding of the responses. The principles proposed in the construction of a coding scheme and its application to judge the responses were tentative, and could be further refined in order to make the scheme more usable for teachers.

Users should also be made aware that for the purpose of collecting information, these responses may merely be categorized on the basis of content, and need not necessarily be quantified.

7.3.2.3 The evaluation of a conative component associated with attitudes

The most serious weakness of the instrument that became apparent only when the results of the questionnaires were analyzed was related to this section. As information about pupil attitudes without the inclusion of a conative element may be incomplete, alternative and more reliable techniques need to be developed to evaluate respondents' overt, or stated behaviour toward the environment (degree of involvement, or activity).

In classroom practice, unobtrusive observation of overt pupil behaviour over a period of time has been considered as a possible alternative, but may prove impractical and unreliable. Experimenting with alternative pencil and paper tests to evaluate this aspect may be an acceptable alternative; the possibility of incorporating it in that section of the instrument that deals with cognitions and affect by simply adding a third question, may be a solution. However, the nature of this question may present a problem, and should be experimented with.

7.4 FINAL REMARK

During the process of development of various aspects of this evaluation technique the confidence in its potential role in developing curricula to accommodate the principles and goals of environmetal education steadily grew. The amount of useful information collected, and the fact that it may have satisfied some important demands of a broader approach to evaluation confirmed by positive and encouraging reports from individual teachers and student-teachers confirmed the need for instruments of this kind.

Severe challenges must be faced in the process of assimilating environmental education in formal education in southern Africa. These can be met only if future developments are grounded on thoroughly researched guidelines.

This project should be regarded as a very tentative venture in an effort to establish some of these guidelines.

7.5 REFERENCES

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APPENDIX A

APPENDIX A

THREE RELEVANT PILOT STUDIES.

During the development of an evaluation instrument to determine pupil orientation toward the natural environment and conservation, three pilot studies were undertaken. Each study was designed to experiment with and improve different aspects of the instrument in order to identify those features that would best suit the requirements spelt out earlier.

In the following paragraphs these pilot studies are discussed and those aspects of each study which contributed toward the development of the final instrument are emphasized.

1. PILOT STUDY 1: QUANTIFYING WILDLIFE ORIENTATIONS

Newgard's (1986) application of the four-dimensional model as described in chapter 4 is limited to "wildlife and some endangered species" and excludes plant life or conservation issues.

In order to investigate whether the model could be adapted to include aspects of the natural environment in general, a pilot study was undertaken (Schreuder 1987). The objectives of this study were:

1. to determine whether the four orientation types toward animals described by Newgard can be identified in a group of pupils in respect of more general aspects of wildlife and conservation;

2. to investigate the suitability and practicability of line drawings as a means of activating responses in pupils;

3. to investigate the possibility (as suggested by Adams, Newgard and Thomas) of applying the evaluation model in a pre-test-post-test situation with an educational experience as the intervention;

4. to test the applicability of the semantic differential as an instrument for the assessment of affective and cognitive aspects of pupil behaviour.

The terms **attitudes** and **perceptions** were used for these aspects for the purposes of this study; in later studies the terms **values** and **cognitions** were used respectively).

An instrument was developed (Appendix A1) in which a number of simple line drawings depicting aspects of wildlife and adverse human actions toward the natural environment were accompanied by seven-point semantic differential item scales. The illustrations were simple black and white line drawings of factories belching smoke; a natural area; a scorpion; a protea; a bulldozer at work; a snake; high-rise city buildings; a springbok; a hunter shooting geese and a domestic cat. The latter was included to illustrate the question type.
In the "perceptions" section the semantic differential items that accompanied each drawing were made up of opposing statements. These were:

Makes the world a better place	Makes the world a worse place
Necessary for healthy human existence	Not necessary for healthy healthy human existence
Improves the quality of life	Devalues the quality of life
Beneficial to nature	Detrimental to nature

The adjective pairs used for assessing "attitudes" were the following:

Pleasant	Unpleasant
Bad	Good
Dark	Bright
Beautiful	Ugly
Clean	Dirty

The standard procedure of reversing some of the word pairs or opposing statements were followed, in which cases the coding was reversed.

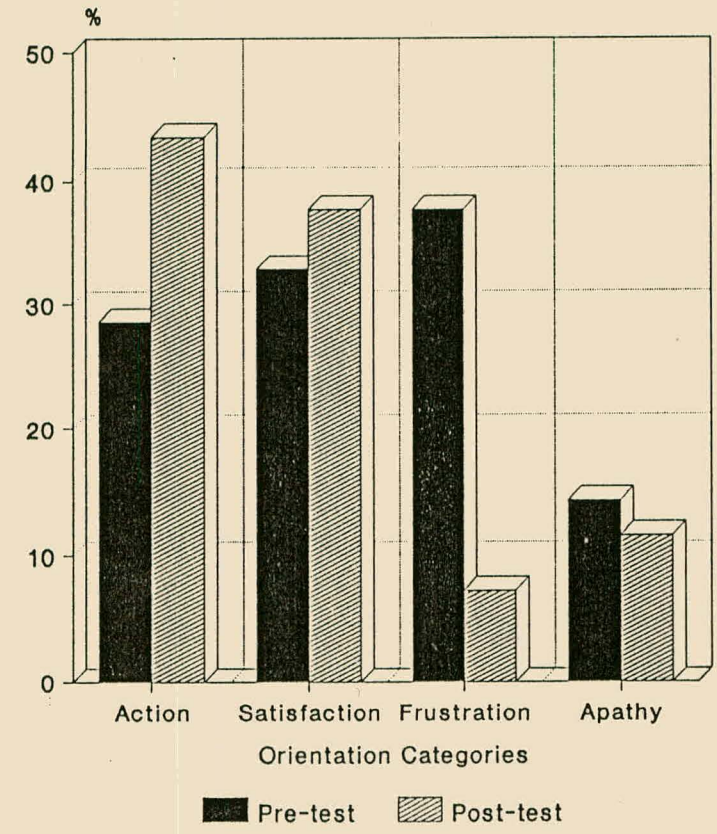
The section on the "activities" (indicated in this study by I [**involvement**]) consisted of eighteen statements about a variety of activities and involvements. These included positive statements such as **reading about nature, making projects, cleaning up litter, using water sparingly and visiting nature reserves**, and negative ones such as **keeping wild animals, killing spiders and picking wild flowers.** Participants had to respond to these statements by ticking either one of three possibilities, namely "I do this"; "I have not, but would like to"; and "I do not like to do this", which carried weights of 2, 1 and 0 respectively. In the case of negative statements the score was reversed.

The respondents consisted of a group of 70 standard eight boys who completed the questionnaire prior to a visit to an environmental education centre. The same questionnaire was administered with the group a week after their return. The pre- and post-questionnaires of individual respondents were not matched. No item analysis or any statistical analysis was carried out.

The total for each model component (**Attitudes**, **Perceptions** and **Involvement**) and a mean for each of these were calculated. For the mean, the totals of the pre- as well as the post-tests were taken into account.

The four-dimensional evaluation model was applied and the number of respondents in each of the categories Action, Satisfaction, Frustration and Apathy was determined by the individual combinations of the three model component scores.

A respondent scored low (**indicated by a,p or i** respectively) when his total was less than the mean score, or high when his total was higher than the mean score (**indicated by A, P or I** respectively).



Means: A -77; P -74; I -62

Figure 1

Graphic Representation of Frequencies of Four Orientation Categories Before and After Intervention

There were eight possible combinations which were broken down into the four groups, namely [API]; [aPI, ApI and apI]; [Api, aPi and APi]; and [api]. These respectively correspond to the four orientation types described earlier, namely Action, Satisfaction, Frustration and Apathy (see fig 5.1).

The distribution of the participants across the orientation categories was an indication of the applicability of the evaluation model, which warranted further investigation. Furthermore, in the post-test a shift of respondents in the respective orientation categories was observed. This was characterized by a substantial decrease in the frustration category with resultant increases in the satisfaction and especially the action category. This was apparent despite the fact that the validity and reliability of the information obtained by the test instrument was not statistically verified, and the fact that some shortcomings were evident in the instrument and its administration.

The shifts that occurred in the orientation categories, and which were demonstrated by the evaluation model, could therefore be regarded as coincidental. However, as the intervention - the education programme at the environmental education centre - was aimed mainly at improving perceptions about conservation and fostering positive environmental values, the possibility that actual improvements in perceptions, attitudes and involvement were reflected by the evaluation model should not be discounted.

The shortcomings identified in the instrument and its administration suggested the following for improvement and further development:

1. The Instrument:

Adjective pairs should be chosen specifically for each illustration instead of a generalized set.

The section on involvement should be carefully planned to correspond more closely to the other two sections.

The use of questions to prompt "open" responses should be considered. This could serve as a control measure to establish the reliability of the structured-type questions, or as an alternative.

The use of photographic material instead of line drawings should be considered.

2. The Administration:

A larger group of respondents should be involved, including a control group, i.e. a group not being exposed to the intervention.

A delayed post-test (about six months after intervention and the first post-test) should be considered to investigate the permanence of any changes identified.

Item-analysis should be done to eliminate undiscriminating test items, and the significance of any changes should be established statistically.

The basic principles on which the original instrument was based were found to be sufficiently adaptable to warrant further development. **The investigation indicated that the orientation categories of social behaviour originally described by Adair and adapted by Newgard to include aspects of wildlife could also be identified in respect of the environment and conservation in general.**

2. PILOT STUDY 2: AN INVESTIGATION INTO STUDENT PERCEPTIONS OF ASPECTS OF THE NATURAL ENVIRONMENT AND CONSERVATION

2.1 OBJECTIVES

The main objective of this pilot study was to develop further some aspects of the measuring instrument, namely

1. using colour photographs instead of line drawings to elicit responses;

2. using "open response" type questions together with the structured type used in the previous investigation.

Another objective was to establish whether teachers of high school biology address certain global ecological and conservation issues in such a way that pupils become aware of these and develop positive value systems toward the natural environment.

The issues and concepts included in the investigation were the following:

1. "Spaceship Earth" as a closed ecosystem
2. Natural resources
3. Fynbos
4. Deforestation
5. Air pollution
6. Desertification
7. Endangered species

8. Food shortage and malnutrition.

As in the previous investigation, it was accepted that if a respondent has been sensitized to a certain concept by a learning experience, **a visual stimulus would provoke a response, expressed in verbal statements of cognitions and values, the quality of which would be determined by the degree of sensitization.**

The previous investigation indicated that visual stimuli could be used to differentiate between perceptions and attitudes within a certain population. One of the objectives of this investigation was to establish whether **the quality of the responses** could be used for a similar differentiation.

The participants were 196 first year students enrolled for a course in Zoology at the University of Stellenbosch. The questionnaire was administered before the lectures commenced at the beginning of the academic year.

2.2 THE VISUAL STIMULI

It was decided to continue using visual stimuli to elicit responses for the following reasons:

1. With a visual stimulus a key concept can be concealed to various degrees, which facilitates differentiation.
2. Certain concepts are difficult to describe. Pollution, Spaceship Earth and Water may serve as examples of concepts that are more easily depicted visually.
3. Reading fatigue is eliminated to a large degree.
4. Some of the terms used to describe a particular concept may give the respondent clues about the expected response.

Colour slides representing the concepts listed were selected and colour transparencies were made.

2.3 THE QUESTIONNAIRE

The questionnaire (Appendix A2) was designed to elicit two types of responses for each visual representation:

* open responses to questions "What do you see?", and "What do you think of it?", and
* structured responses to semantic differential items. These items were designed in such a way that the adjective pairs directly referred to the visual representation in question. The two question types were included as a control measure and to compare their relative worth in assessing attitudes.

At the end of the questionnaire the respondents were asked to write a short paragraph indicating a possible relationship between the different concepts illustrated by the transparencies.

2.4 ADMINISTRATION AND EVALUATION OF RESPONSES

The colour transparencies were numbered, flashed on to a screen and the group was allowed three minutes to respond to each. No communication was allowed during the completion of the questionnaire, and no comments were made about any of the representations.

A random sample of fifty of the completed questionnaires was drawn, and the responses for each concept were analyzed **in respect of cognitions** (the responses to the questions "What do you see?)" and **affect** (the responses to the questions "What do you think of it?"). (For the purpose of the study, the latter scores were referred to as attitude scores.)

Similar responses for each concept were grouped and clustered, resulting in different response types for both cognitions and values for each concept. Together with a full set of colour prints, these were submitted to seven independent judges who were requested to rank the respective response types for each concept on a five-point scale.

On the basis of these rankings, a series of possible responses for each concept was drawn up, graded on a five-point scale. This was done for both cognitions and attitudes. Thus a high quality verbal statement of affect would earn five points, and a low quality statement one. If no expression of affect could be identified, no marks were given. The same principle was applied to the cognitive statements.

The marks for cognition (c) and attitude (a) were added up to constitute, for the purpose of this study, **perception scores** in accord with Holahan's description of perceptions (1984:23-24). In this study, there were two perception scores for each concept, namely the abovementioned results of the open responses (Perceptions 1) and the scores for the semantic differential items (Perceptions 2).

A full discussion of the results for the individual concepts appears in the report (Schreuder op. cit.:7-14), and a table summarizing the results is included as Appendix C. These results are presented graphically in fig.2 below:

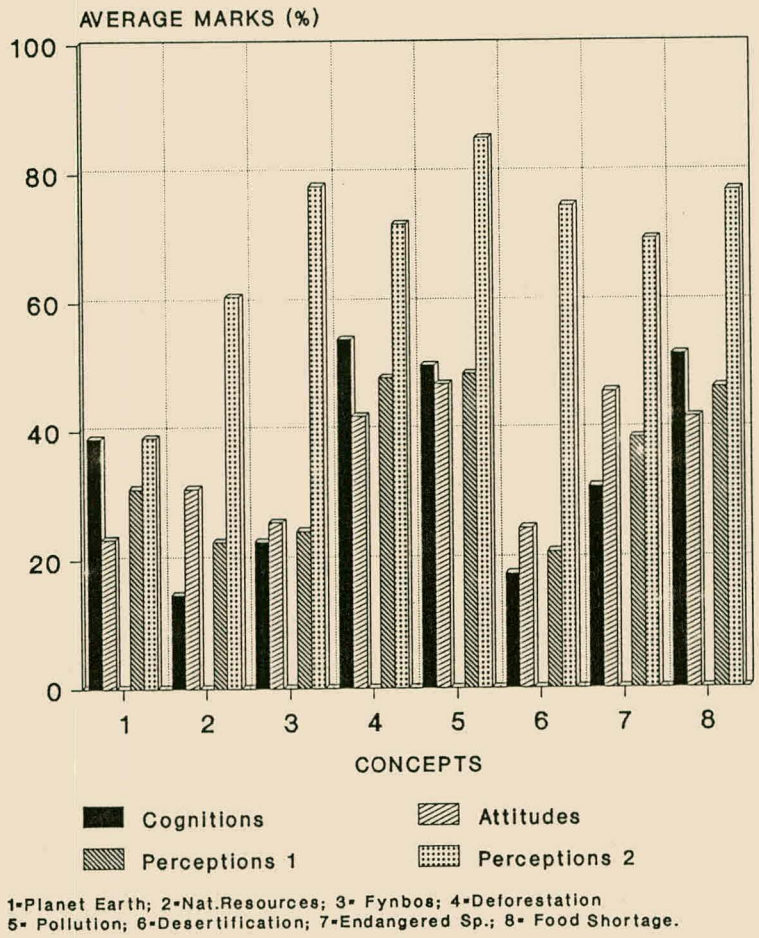


Fig 2

Graphic Representation of the Average Cognitions, Attitudes and Perceptions Marks.

The responses to the last question, where respondents had to describe a possible relationship between the various concepts, were analyzed and clustered, and six main categories of responses could be identified:

1. referring to the relationship between man and nature;
2. **referring to the destructive role of man, and the need for conservation;**
3. referring to conservation;
4. referring to the destructive role of man;
5. referring to various environmental problems;
6. various unclassifiable responses

(* Category 2 was judged to be the ideal response)

The results of this analysis are represented in the graphic representation in fig. 3 below.

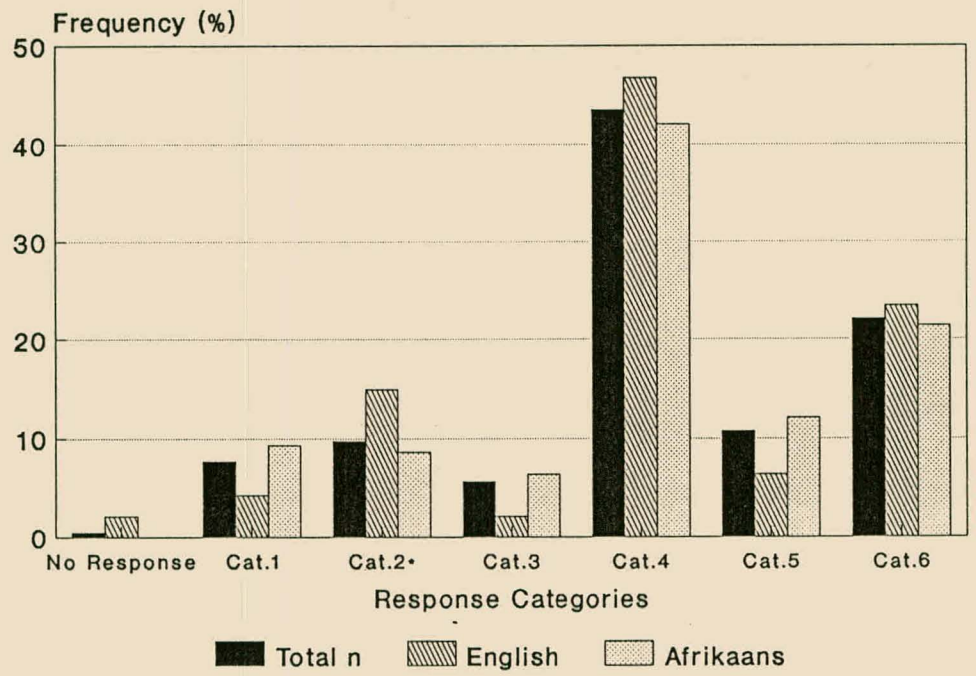


Figure 3

Graphic representation of frequencies of response categories with regard to a possible relationship between concepts represented

Those observations with direct bearing on the further development of a measuring instrument can be summarized as follows:

Except in the case of Earth (concept 1), there was no obvious correlation between the average marks for perceptions as reflected by the two test types.

Positive correlations between the cognitions and attitudes responses were recorded for all concepts with the exception of Natural Resources (concept 2) and Desertification (concept 6). These exceptions can probably be explained by a incorrect selection of the visual material (Schreuder 1989: 9,11).

In three of the concepts represented, namely Deforestation (concept 4), Pollution (concept 5) and Food Shortage and Malnutrition (concept 8), the open response (Perception 1) scores recorded were significantly higher than the corresponding scores for the other concepts.

Overall, the instrument satisfactorily differentiated between respondents and the potential for educational use was regarded as sufficient to warrant further development.

The results of the second analysis (relationships between the concepts) were encouraging since 53% of the respondents could satisfactorily identify man as instrumental in causing environmental problems. On the other hand, a relatively low percentage of respondents expressed the need for responsible human action, and a total of 43% of respondents failed to see any relationship between the different representations.

The findings led to a number of conclusions about the teaching of biology at high school level, and a number of recommendations were made in this regard. The most important of these were the need for further research to confirm some of the findings of this pilot study (Schreuder 1989:14-16).

Apart from these, valuable experience was gained in terms of the development of an evaluative instrument for the purposes described earlier. The following became clear:

It appeared that line drawings are more suitable for this type of investigation. Responses to colour pictures were influenced by factors such as colour, the quality of the picture and detail in the picture itself. The advantages of line drawings are that certain aspects can be consciously emphasized, and pilot testing enables the evaluator to change or adapt certain aspects of the drawings. It furthermore proved difficult to select colour slides that explicitly depict certain concepts. This problem was further complicated by the necessity that the visual stimuli should be of comparable quality and standard so as not to influence the quality of the responses.

The value and potential of visual stimuli for eliciting cognitive and affective responses was confirmed further. As in the previous study, the results of this pilot investigation showed that these stimuli could differentiate sufficiently within a certain population so as to make meaningful analysis possible.

The "open" response offer more possibilities for further analysis than the structured response, despite a number of problems encountered. The first of these was the difficulty in selecting adjective pairs for the semantic differential that would truly represent the perceptions of the respondents without extensive prior pilot-testing.

Second, little correlation could be found between the structured and open responses, probably because the "ideal" responses to the semantic differential items were more readily anticipated by the respondents, hence the relatively high average scores.

Third, there were word pairs in each of the items that elicited responses that did not match the rest of the set (see bold figures in table 5.1). Should a proper item analysis be executed, these figures would probably have to be ignored, resulting in even more unrealistically high mean scores.

One of the requirements of the evaluation instrument that is to be developed is that it should enable the teacher to identify possible

weaknesses as well as improvements in various aspects of pupil behaviour. The latter would require the use of the instrument in a pre-post situation. This study showed that for both these purposes, the structured response had definite disadvantages when compared to the open type.

The question that was to stimulate cognitive responses ("What do you see?") was found to leave too much scope for interpretation, and purely descriptive responses were often encountered. This inevitably also influenced the attitudinal responses, as a number of respondents stated their feelings about the illustration and not the concept represented. This factor must have had a negative influence on the validity of the results.

No standardization was carried out to establish whether the instrument differentiated between groups, i.e. whether a comparable group who had no biological background, or who was taught in a different way would have reacted differently under similar conditions.

The fact that the grading of the responses was spread over a five-point scale made the evaluation of responses difficult. A three-point scale would probably solve this problem to some extent, as a greater variety of equivalent responses could be clustered around values of 1, 2 or 3 respectively. As it is not the purpose of this type of instrument to assess the academic standard of a participant in the way a normal examination paper is supposed to, but to serve for diagnostic purposes, using a three-point scale should supply sufficient information for the type of analysis suggested.

Most valuable for future development was the information gained from the analysis and evaluation of open responses. The suggestion made earlier that this type of response might yield more information than structured responses was partially confirmed, and for this reason it was decided to develop this method further.

In a subsequent investigation the technique of analyzing this type of response was further refined. A further aspect that underlines the value of this type of evaluation came to the fore when groups of different cultural and socioeconomic backgrounds were included in the test group.

3 PILOT STUDY 3: ASSESSING THE IMPACT OF A MUSIC VIDEO ON PUPIL PERCEPTIONS ABOUT WILDLIFE AND CONSERVATION

3.1 GENERAL BACKGROUND, OBJECTIVES AND RESEARCH DESIGN

The main objective of this investigation was to evaluate the impact of a planned intervention in the form of a music programme on the pupils' awareness of wildlife and conservation.

The rationale behind the music programme was to sensitize black teenagers for the need for conservation. The music programme was therefore aimed at mainly black teenagers, and the visual material included scenes of wild animals, natural vegetation and flora, and scenes depicting the destruction of nature brought about by man. These were alternated with studio shots featuring a rock group and an accompanying choir consisting of black and white children.

The investigation was designed to establish whether the programme might have had any impact on the listeners' cognitions of, and/or attitudes toward wildlife and conservation.

The test group consisted of 416 high school pupils, 202 white and 214 black from both rural and urban areas.

The investigation was carried out as an quasi-experimental study; a pre-test was followed by exposure to the music programme, after which the post-test was done. The pre-test was therefore designed to obtain some information on participants' perceptions, i.e.cognitions of and values toward aspects of the natural environment and conservation, especially those addressed by the programme.

The post-test was designed to find out how the programme as a whole was received by the target audience, and whether repeated exposure to the programme had any influence on the viewers' perceptions of wildlife and conservation.

Those aspects aimed at evaluating cognitive and affective changes had direct implications on the subsequent development of an evaluation instrument and its administration in an experimental situation. Some of these implications will be discussed in the subsequent paragraphs.

3.2 THE QUESTIONNAIRE (APPENDIX A3)

An important part of the investigation was the determination of aspects of perceptions about wildlife and nature. For the purpose of this study, only those aspects are discussed. A full report containing all relevant findings is available (Le Roux, A. and Schreuder, D.R., 1988).

It was accepted that the programme was not intended to be a learning, but rather a **sensitizing** experience, and therefore no significant increase in knowledge or awareness was anticipated. As a sensitizer, the programme was aimed more at addressing values and for this reason open responses prompted by illustrations and statements were analyzed. These yielded substantial amounts of information, not only on levels of awareness, but also on attitudes toward aspects of wildlife and conservation.

Line drawings representing aspects of nature and human impact on nature based on the visual material contained in the programme, were accompanied by questions where respondents were required to write down what they felt by looking at the respective pictures.

Three other types of items were included to determine respondents' perceptions. For the first of these respondents were requested to write down the names of plants and animals they were concerned about. Mention of endangered species was regarded as the ideal response. For the second, respondents were requested to complete statements starting with "I feel...", "I am..." and "I want to..." when thinking about nature and conservation.

For the third item respondents were required to write down those human actions that might adversely affect nature and wildlife. All these items were directly related to aspects included in either the lyrics or the visual material of the programme.

An item where respondents had to indicate how important wildlife is to them was included as a divider. A direct relationship was shown to exist between the responses to this item and the perceptions of pupils, especially those of black pupils.

3.3 EVALUATING THE RESPONSES

As a possible change in perception was one of the aspects to be investigated, it was regarded as important that only one person be involved in the actual marking of the questionnaires. Responses of the Xhosa-speaking respondents were translated into English prior to marking.

As in the previous investigation, the responses to both the items (naming plants and animals concerned about, and line drawings) were analyzed and evaluated in respect of the **quality of both cognition and emotion (affect)** expressed in the responses.

By comparing the pre- and post-responses of any given participant, any positive change in perception could be detected. It was accepted that any such change could be ascribed to exposure to the programme.

Any such recognizable change was quantified by allocating marks (hereafter referred to as the V-score) to every valid response. The totals of the V-scores were regarded as indicative of a change in perception as a result of exposure to the programme. Striking differences in black and white reactions led to further analysis of pre- and post-responses in order to determine the **level of perception** of each respondent before and after intervention. For this purpose marks were allocated (referred to as P1 in the pre-test, and P2 in the post-test) on a scale of 0 to 2, depending on the degree to which the response was acceptable in terms of conservation. The difference between the total scores, referred to as P2P1, serves as a further indication of change in perception.

3.4 RESULTS

As the possible influence or the respondents' evaluation of the programme has no bearing on the further development of an evaluation instrument, only those findings of the pre-test considered to be directly pertinent will be discussed in detail.

3.4.1 ENDANGERED SPECIES

For the test items where respondents had to name those plants and animals they were concerned about, clear trends could be identified.

Judged solely by the types of plants and animals mentioned, these items pointed to a significant difference between the white and black respondents, as shown in the following table.

RESPONSE CATEGORY	BLACK		WHITE	
PLANTS	**Freq**	**%**	**Freq**	**%**
Endangered species	1	0,32	37	12,01
Trees/Forests	31	10,06	10	3,25
Wild plants	40	12,99	48	15,58
Domestic/crop plants	131	43,18	2	0,65
Other	2	0,65	4	1,30
TOTAL	207	67,21	101	32,79
ANIMALS	**Freq**	**%**	**Freq**	**%**
Endangered species	23	3,48	169	25,61
Wild mammals	106	16,06	42	6,36
Birds	11	1,67	7	1,06
Reptiles	2	0,30	7	1,06
Fish	0	0,00	1	0,15
Domestic animals	260	39,39	15	2,27
Other	8	1,21	9	1,36
TOTAL	410	62,12	250	37,88

Table 4

Comparison of black and white pupils' response regarding plants and animals they feel concerned about (pre-test)

While white pupils have mainly showed concern for wild, and often endangered species of plants and animals, the majority of black respondents showed concern for domesticated animals and plants, especially flowers and crop plants. Animals which the black group most frequently mentioned were dogs and horses. It seems that this

group is concerned mainly about those plants and animals that are directly beneficial to them. Similar findings were described by Kellert (1984) among black American respondents - an attitude type that he has termed **utilitarian.**

3.4.2 HUMAN ACTIONS THAT ENDANGER WILDLIFE

While white respondents mentioned mainly hunting (57,35%), pollution (37,25%) and littering (22,5%), blacks frequently mentioned fires (26,64%), removal of trees (14,02%) and social issues (19,63%) as those human actions that pose a threat to wildlife. The latter included robbery, rape, abuse of liquor, and burning down of houses.

These results may be ascribed to the possibility that the question was misinterpreted. However, the possibility that the results may also be due to the influence of the social environment on the attitudes and perceptions of the respondents cannot be excluded.

Again, black pupils' concern for domestic animals was indicated in a number of responses expressing disapproval of people not looking after (domestic) plants or animals.

The white pupils' total response frequency for this item was significantly higher than for the previous item, and also higher than the black group. This might point to the white group's greater awareness of the adverse effect of humans on wildlife and nature.

3.4.3 RESPONSES TO LINE DRAWINGS DEPICTING SCENES FROM THE VISUAL MATERIAL OF THE PROGRAMME

The question accompanying the illustrations was "What do you think of when you look at the following pictures?" The rationale behind this formulation was that a single question might prompt responses containing both cognitive and affective elements.

The following trends were recorded for each of the illustrations:

(i) **Picture of a bulldozer at work**

Of the white respondents, 45,8% expressed aversion to the destruction represented by this illustration, in contrast to 13,1% of the black respondents. However, 69,2% of the black respondents regarded the bulldozer as advantageous to building roads and housing sites, in contrast to 47,3% of white respondents.

(ii) **Picture of a lion lying peacefully**

The majority of white respondents (66,5%) expressed admiration (freedom, majesty, wonder of creation), in contrast to 55,2% the black respondents who described the animal as dangerous or hungry.

(iii) **Picture of a rhino, the telescopic sight of a rifle superimposed on its head**

The act of hunting an endangered animal was recognized by 97,5% of whites and 17,3% of black respondents have reacted similarly. The dangerous animal response was expressed by 22,0% of the black respondents, while 29,4% of this group identified the animal as either an elephant or a "cowfish".

(iv) **Picture of a monkey in a cage**

Reactions expressing aversion to the capture of wild animals were recorded by 69,1% of the white group, and by 10,3% of the black. The dangerous animal response was again recorded among black respondents (4,7%) while 12,6% of this group stated that this animal was not dangerous (now). A significant number associated this animal with a character in Xhosa folklore. This, and the fact that the rhino also reminded some of the respondents of a Xhosa proverb ("every elephant must bear its own trunk") confirms the argument that cultural background has a strong influence on perceptions about wildlife.

TEST ITEM		Pre P1	Post P2	P2P1	Diff V
Plants concerned	B	0,19	0,39		0,23
	W	0,67	0,83		0,17
Animals concerned	B	0,29	0,39		0,89
	W	1,57	0,83		0,51
Human actions	B	0,822	0,39		0,79
	W	2,613	0,83		0,56
Bulldozer	B	0,22	0,39		0,54
	W	0,78	0,83		0,43
Lion	B	0,02	0,39		0,10
	W	0,11	0,83		0,09
Rhino	B	0,29	0,39		0,13
	W	1,83	0,83		0,09
Monkey	B	0,08	0,39		0,12
	W	0,69	0,83		0,12
TOTAL	B	1,925	4,196	2,271	2,790
	W	8,299	10,25	1,946	1,971

Figure 5

Mean perception marks per item (B = black W = white

3.4.4 THE DETERMINATION OF THE PERCEPTIONS OF RESPONDENTS

The mean perception marks for each of the test items discussed are compared in figure 5.

From the above it can be deduced that the mean white respondents' perception marks, especially the P1-count (t = 20,48) representing initial perceptions, were markedly higher. A meaningful improvement was recorded for the black respondents as represented by both the V-score (t(V)=4,31) and the P2P1-score. This is also reflected by the relatively high number of white responses in which no

improvement of perceptions could be detected. For 28% of white respondents a P2P1-score of 0, and for 21% a V-score of 0 was recorded.

It therefore seems that in general the white respondents **did not learn much from the programme**. However, one must remember that the initial perceptions of this group were perceptibly higher than those of the black group; also, while there was no white respondent with a P1=0 or P2=0, this was recorded in 31,8% and 9,3% respectively of the black group.

This investigation indicates the existence of distinctive attitudes especially among the black group. More important, is the fact that **a programme that was never intended to be an educational experience did bring about certain improvements in perceptions about wildlife and conservation, so stressing existing learning needs.**

The investigation also indicated the possible influence of cultural and socioeconomic background on peoples' values and perceptions. What makes this notable is the fact that the instrument was not specifically designed to point out these tendencies, nor to compare the two groups taking part in the investigation. This should be ascribed to the open responses; it is doubtful whether a structured questionnaire would have yielded similar results.

For the purpose of research in the field of environmental education this investigation reaffirmed the advantages of the type of questionnaire where visual stimuli are combined with open questions. If this technique of evaluating open responses can be further refined in respect of the quality of the statements of both cognitions and affect, a more dependable reflection of pupil attitudes can be obtained.

This investigation was valuable to the development of a practical evaluation instrument mainly because:

* the potential of visual stimulation as a means of eliciting a response was further confirmed;
* the technique of analyzing open responses was further refined;
* this type of evaluation technique pointed out basic differences in pupils' perceptions.

4. CONCLUSION

In conclusion, the main findings of the three investigations described in this Appendix that contributed positively toward the development of the evaluation instrument will be discussed briefly.

4.1 INVESTIGATING WILDLIFE AND CONSERVATION ORIENTATION

The main finding of this investigation was the partial confirmation that the four-dimensional evaluation model as described by Adair (1973) proved highly adaptable, applicable and practical.

As the four categories (action, satisfaction, frustration and apathy) are defined in terms of cognitions, attitudes and activity, this model showed definite potential for use in environmental education. Not only can it serve diagnostic purposes, but applied in an experimental design, it can further serve as a convenient indicator of the degree of positive change, as any shift from one category to the other as a result of intervention can be readily observed and interpreted.

Using illustrations depicting certain key concepts to elicit responses instead of a question proved to have definite advantages, as this resolved some of the problems of semantics that are liable to affect the reactions of respondents.

Aspects needing further development are the following:

* The inclusion of a control group may be desirable in order to standardize the instrument and ensure increased validity.
* The structured items manifested certain limitations that made them less suitable for this type of evaluation. Selecting suitable alternatives specific to a certain concept to include all the possible responses was found difficult.

4.2 INVESTIGATING STUDENT PERCEPTIONS ABOUT CONSERVATION ISSUES

For the purpose of this study, perceptions were defined as **verbal expressions of cognitions and affect.** Respondents had to react to each of eight colour transparencies by writing down what they saw and how they felt about it.

Positive elements that proved to be worth developing further were the open-type response and the line drawings:

* The open-type response offered opportunities for more thorough analysis, while at the same time discriminating satisfactorily between both the cognitive and affective aspects of pupil responses.
* The open-type responses were also a more dependable and informative source of information regarding the various aspects of pupil perceptions about the environment and conservation. In a pre-post evaluation, the open-type responses could be more suitable to detect any change.
* Line-drawings might be better than colour photographs for eliciting responses reflecting cognitions of, and values held toward, the concept depicted.

The semantic differential might prove inoperable in an evaluation instrument for classroom use, as the selection of suitable word pairs which are critical to the exercise, was very difficult.

A suspected relatively low level of awareness of global conservation issues was identified. This warrants further research.

4.3 AN EXPERIMENTAL DESIGN FOR ASSESSING THE INFLUENCE OF AN INTERVENING PROGRAMME

This was the first investigation in which the experimental design was attempted, and which include different ethnic groups. One of the most valuable conclusions reached was that basic differences do exist between white and black pupils.

These differences were especially evident in values held toward natural objects and concepts, and must have an important influence on learning and education in

general. What makes these findings more remarkable is the fact that the instruments used were not specifically designed to compare these groups; the white group was merely included as a control measure as the previous two investigations were both directed at a white target group.

Several open response items were used, and to a lesser extent than in the previous instruments, also line drawings. All these items proved to be potentially useful in studies of this nature, although the evaluation of the actual responses proved to be troublesome.

The most important contributions of this study were the following:

* It confirmed the usefulness of the open response in obtaining adequately defined representations of pupil perceptions and in analyzing factors.
* It stressed the necessity of including different ethnic groups in educational research in a multi-cultural society.
* Pilot-testing in order to ensure the inclusion of appropriate test items was found to be a prerequisite.

The design, development and administration of the final instrument as described in chapter six, were based on the valuable experience gained by these studies. This experience is of great importance, as few similar evaluative instruments are known to be in effective use. For environmental education in Southern Africa at present it is essential that research of this nature lead the process of educational development.

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APPENDIX A-1

UNIVERSITEIT VAN STELLENBOSCH
UNIVERSITY OF STELLENBOSCH

VRAELYS OOR BEWARINGSGEDRAG

Met hierdie vraelys word 'n poging aangewend om die mening van 'n groep hoërskoolleerlinge oor sekere aspekte van die mens se omgewing te bepaal. Let asseblief op die volgende:

1. Jou eerlike opinie op elke vraag is van baie groot belang.

2. Alle vrae of stellings moet beantwoord word, selfs al is jy nie heeltemal seker van 'n antwoord nie.

3. Daar is geen regte of verkeerde antwoorde nie - slegs jou mening of gevoel word gevra.

4. Daar is geen manier waarop jy geïdentifiseer kan word nie.

5. BELANGRIK : Alle vrae word beantwoord deur slegs 'n kringetjie met potlood rondom die betrokke syfertjie of letter in 'n blokkie te maak, behalwe in die geval van jou ouers se beroepe.

6. MOENIE merke maak in die kantlyn aan die regterkant nie - dit is vir kantoorgebruik.

7. Baie dankie vir jou vriendelike samewerking. Daarsonder sou die sukses van hierdie projek nie moontlik wees nie.

PERSOONLIKE BESONDERHEDE

1 1 Kaartr

2 - 4 Rekord

1. GESLAG :

	1	
	2	

5

2. OUDERDOM :

13	1	
14	2	
15	3	
16	4	
17	5	
17+	6	6

3. SKOOLVAKKE WAT JY TANS NEEM :

Biologie	1	7
Skeinat	2	8
Geografie	3	9
Geskiedenis	4	10
Ekonomie	5	11
Huishoudkunde	6	12
Landbou	7	13
Houtwerk	8	14
Wiskunde	9	15
Boekhou	10	16
Tik	11	17

4. (a) BEROEP VAN VADER

Het nie 'n vader nie	99	18-19

(b) BEROEP VAN MOEDER

Het nie 'n moeder nie	99	20-21

5. WOONPLEK :

Dorp	1	
Plaas	2	
Stad	3	22

6. HUISTAAL

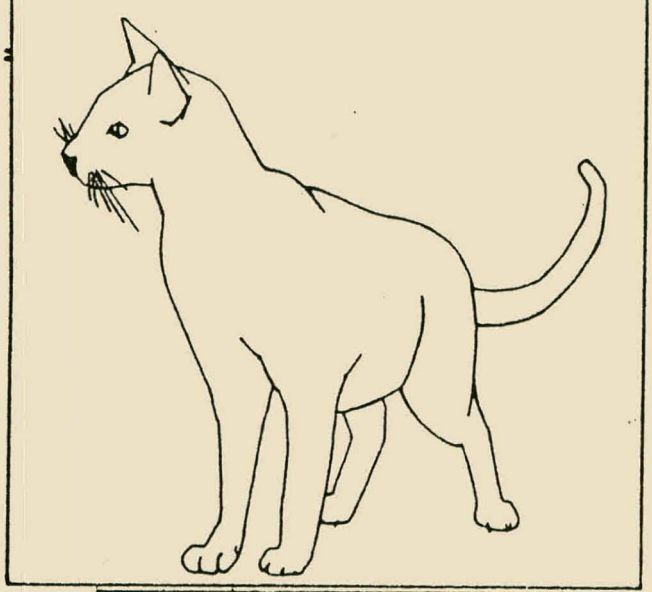
Afrikaans	1	
Engels	2	
Ander	3	
		23

AFDELING A

In hierdie deel van die vraelys word 'n poging aangewend om vas te stel hoe jy sekere begrippe verstaan en interpreteer.

Die toets bestaan uit 'n reeks illustrasies, met 'n reeks stellings by elkeen. Elke stelling het 'n teenoorgestelde, met sewe blokkies tussen die twee. Deur 'n sirkel met **POTLOOD** in 'n toepaslike blokkie te maak kan jy 'n aanduiding van jou siening gee.

Voorbeeld:



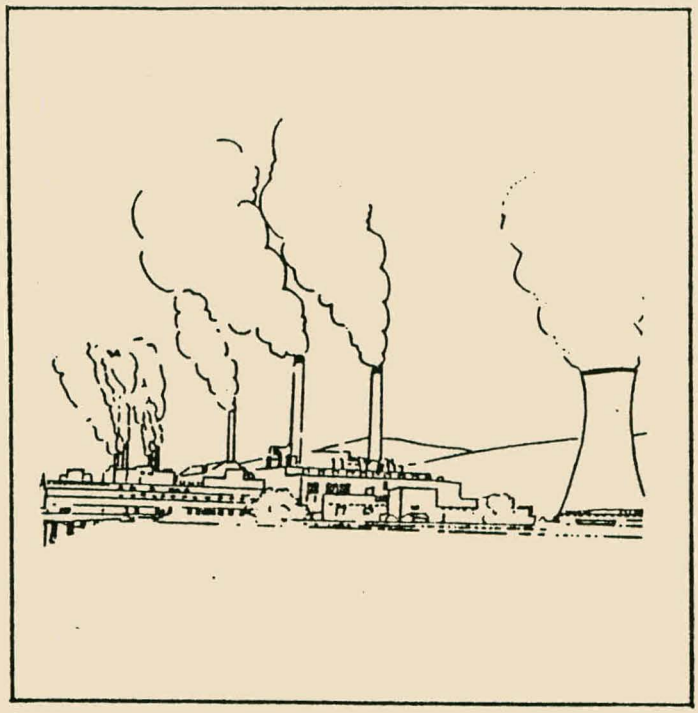
'n Lastige dier	(1)	2	3	(4)	5	6	(7)	**'n Dier wat baie plesier verskaf**

'n sirkel in 2 sal beteken dat jy nogal saamstem dat 'n kat lastig is;

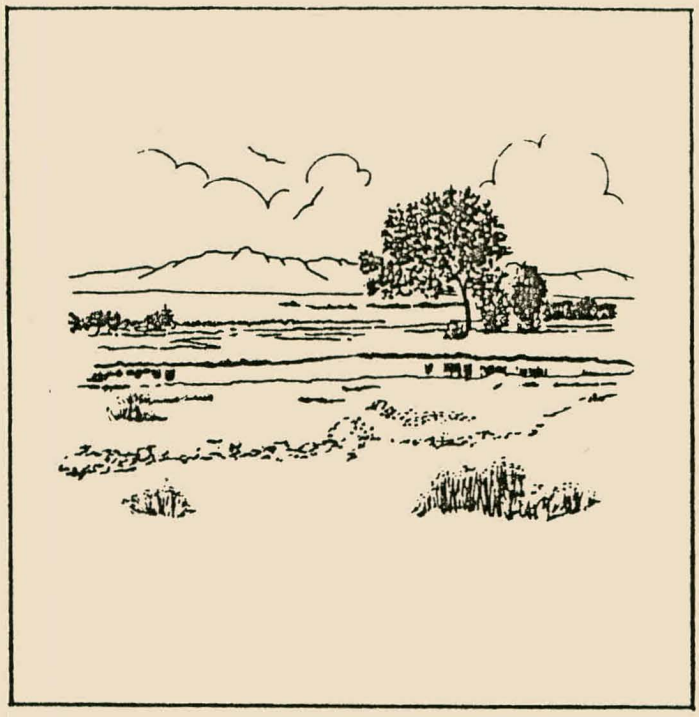
'n sirkel in 4 beteken jy dink 'n kat is lastig, maar hy kan tog vir jou baie plesier verskaf.

'n sirkel in 7 beteken jy stem glad nie saam dat 'n kat lastig is nie; hy verskaf baie plesier.

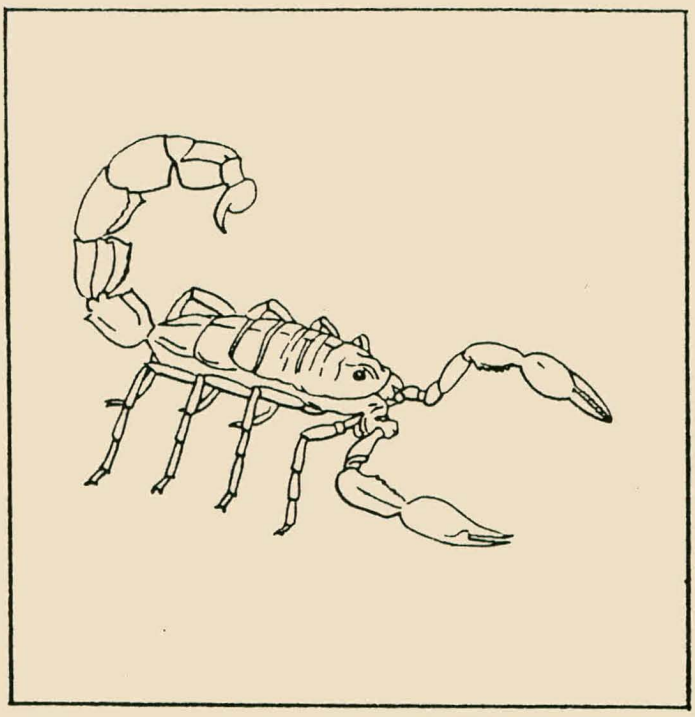
Probeer nou bladsye 2-10 Onthou, ALLE stellings van ALLE illustrasies moet beoordeel word.



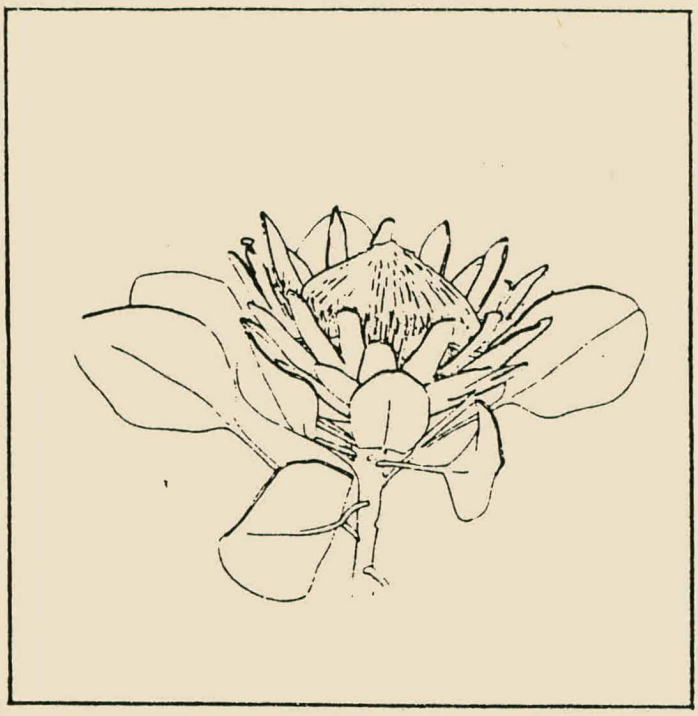
Maak die wêreld 'n beter plek	1	2	3	4	5	6	7	Maak die wêreld 'n slegter plek	24
Noodsaaklik vir 'n gesonde menslike voortbestaan	1	2	3	4	5	6	7	Nie noodsaaklik vir 'n gesonde menslike voortbestaan	25
Verhoog die mens se lewenskwaliteit	1	2	3	4	5	6	7	Verlaag die mens se lewenskwaliteit	26
Strek die natuur tot voordeel	1	2	3	4	5	6	7	Strek die natuur tot nadeel	27



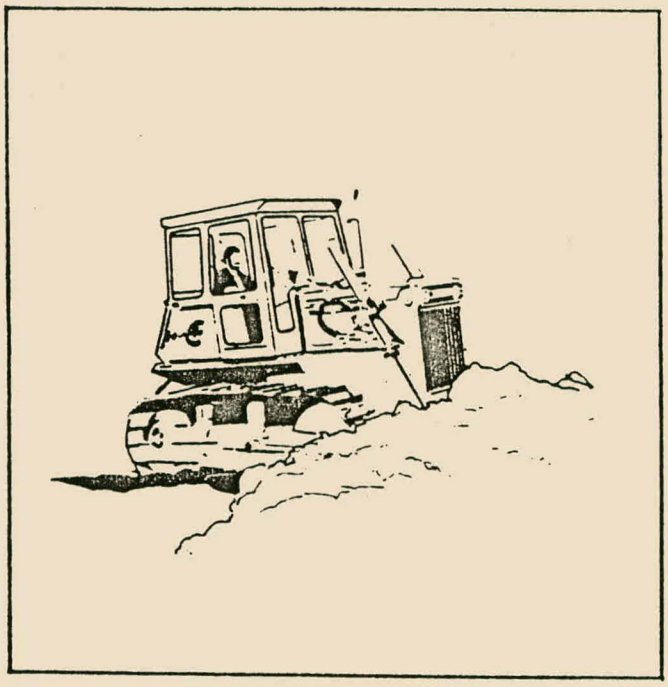
Maak die wêreld 'n beter plek	1	2	3	4	5	6	7	Maak die wêreld 'n slegter plek	28
Noodsaaklik vir 'n gesonde menslike voortbestaan	1	2	3	4	5	6	7	Nie noodsaaklik vir 'n gesonde menslike voortbestaan	29
Verhoog die mens se lewenskwaliteit	1	2	3	4	5	6	7	Verlaag die mens se lewenskwaliteit	30
Strek die natuur tot voordeel	1	2	3	4	5	6	7	Strek die natuur tot nadeel	31



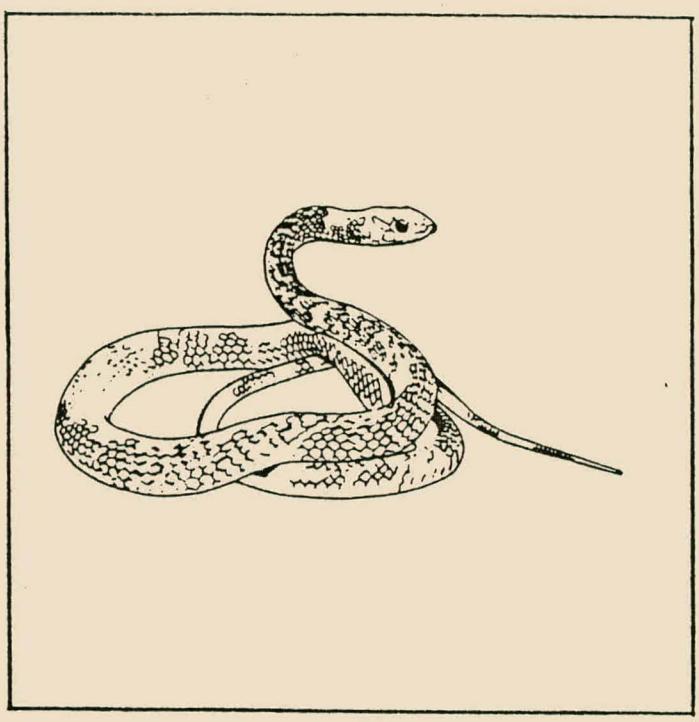
Maak die wêreld 'n beter plek	1	2	3	4	5	6	7	Maak die wêreld 'n slegter plek	32
Noodsaaklik vir 'n gesonde menslike voortbestaan	1	2	3	4	5	6	7	Nie noodsaaklik vir 'n gesonde menslike voortbestaan	33
Verhoog die mens se lewenskwaliteit	1	2	3	4	5	6	7	Verlaag die mens se lewenskwaliteit	34
Strek die natuur tot voordeel	1	2	3	4	5	6	7	Strek die natuur tot nadeel	35



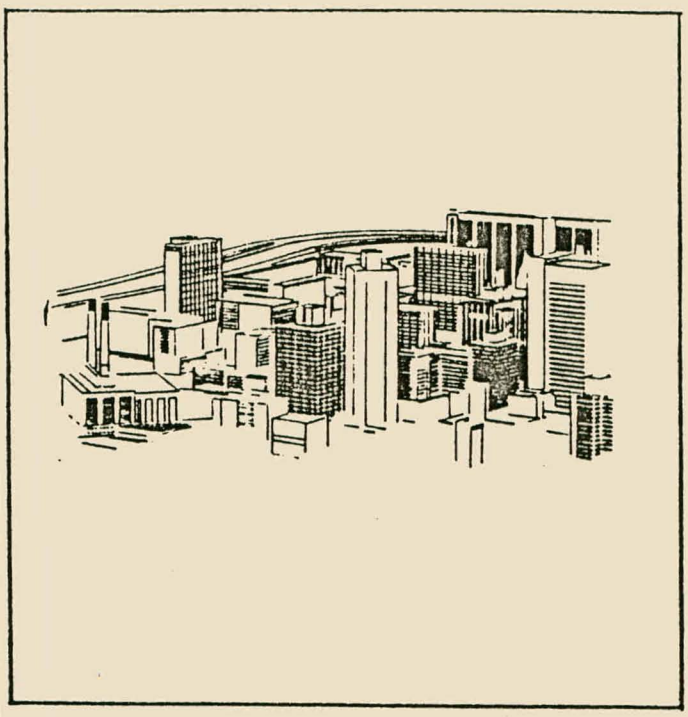
Maak die wêreld 'n beter plek	1	2	3	4	5	6	7	Maak die wêreld 'n slegter plek	36
Noodsaaklik vir 'n gesonde menslike voortbestaan	1	2	3	4	5	6	7	Nie noodsaaklik vir 'n gesonde menslike voortbestaan	37
Verhoog die mens se lewenskwaliteit	1	2	3	4	5	6	7	Verlaag die mens se lewenskwaliteit	38
Strek die natuur tot voordeel	1	2	3	4	5	6	7	Strek die natuur tot nadeel	39



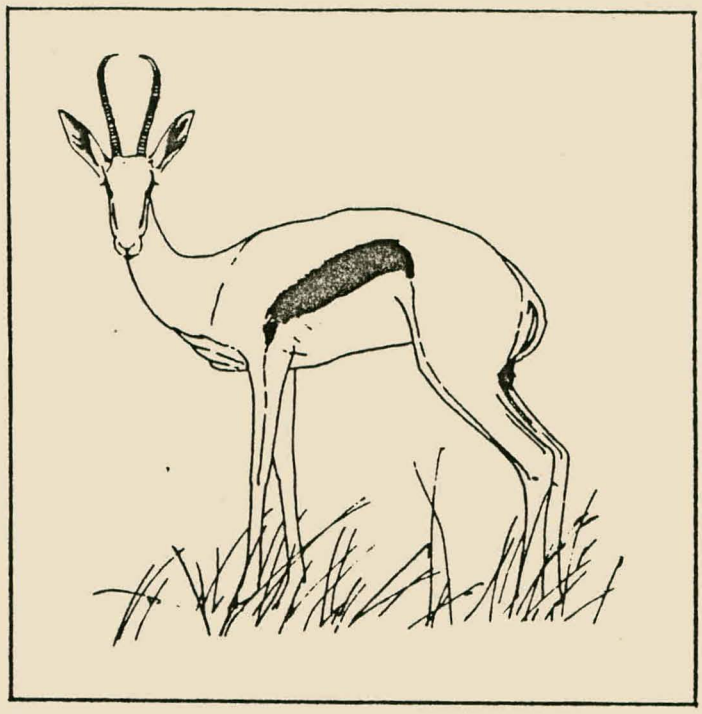
Maak die wêreld 'n beter plek	1	2	3	4	5	6	7	Maak die wêreld 'n slegter plek	4(
Noodsaaklik vir 'n gesonde menslike voortbestaan	1	2	3	4	5	6	7	Nie noodsaaklik vir 'n gesonde menslike voortbestaan	4
Verhoog die mens se lewenskwaliteit	1	2	3	4	5	6	7	Verlaag die mens se lewenskwaliteit	4
Strek die natuur tot voordeel	1	2	3	4	5	6	7	Strek die natuur tot nadeel	4



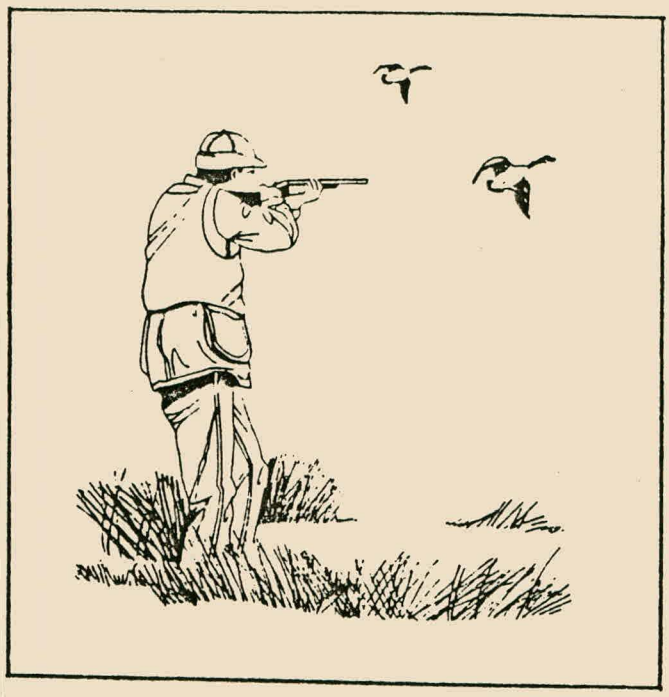
Maak die wêreld 'n beter plek	1	2	3	4	5	6	7	Maak die wêreld 'n slegter plek	44
Noodsaaklik vir 'n gesonde menslike voortbestaan	1	2	3	4	5	6	7	Nie noodsaaklik vir 'n gesonde menslike voortbestaan	45
Verhoog die mens se lewenskwaliteit	1	2	3	4	5	6	7	Verlaag die mens se lewenskwaliteit	46
Strek die natuur tot voordeel	1	2	3	4	5	6	7	Strek die natuur tot nadeel	47



Maak die wêreld 'n beter plek	1	2	3	4	5	6	7	Maak die wêreld 'n slegter plek	48
Noodsaaklik vir 'n gesonde menslike voortbestaan	1	2	3	4	5	6	7	Nie noodsaaklik vir 'n gesonde menslike voortbestaan	49
Verhoog die mens se lewenskwaliteit	1	2	3	4	5	6	7	Verlaag die mens se lewenskwaliteit	50
Strek die natuur tot voordeel	1	2	3	4	5	6	7	Strek die natuur tot nadeel	51



Maak die wêreld 'n beter plek	1	2	3	4	5	6	7	Maak die wêreld 'n slegter plek	5
Noodsaaklik vir 'n gesonde menslike voortbestaan	1	2	3	4	5	6	7	Nie noodsaaklik vir 'n gesonde menslike voortbestaan	5
Verhoog die mens se lewenskwaliteit	1	2	3	4	5	6	7	Verlaag die mens se lewenskwaliteit	5
Strek die natuur tot voordeel	1	2	3	4	5	6	7	Strek die natuur tot nadeel	5



Maak die wêreld 'n beter plek	1	2	3	4	5	6	7	Maak die wêreld 'n slegter plek	56
Verhoog die mens se lewenskwaliteit	1	2	3	4	5	6	7	Verlaag die mens se lewenskwaliteit	57
Strek die natuur tot voordeel	1	2	3	4	5	6	7	Strek die natuur tot nadeel	58

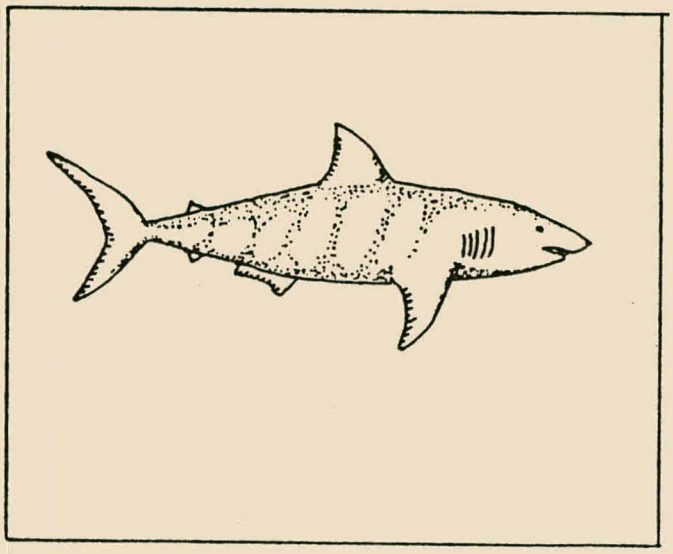
59-60

AFDELING B

In hierdie afdeling moet jy 'n aanduiding gee van hoe jy voel teenoor sekere aspekte van die menslike omgewing-

Soos in die vorige afdeling verskyn daar weer 'n reeks illustrasies, met onder elkeen 'n stel byvoeglike naamwoordpare. Tussen elke woordpaar kom weer 'n sewepuntskaal voor waar jy jou reaksie met 'n potloodsirkel moet aandui.

Voorbeeld: Hieronder verskyn 'n illustrasie van 'n **haai**, met die woordpaar goed - sleg.

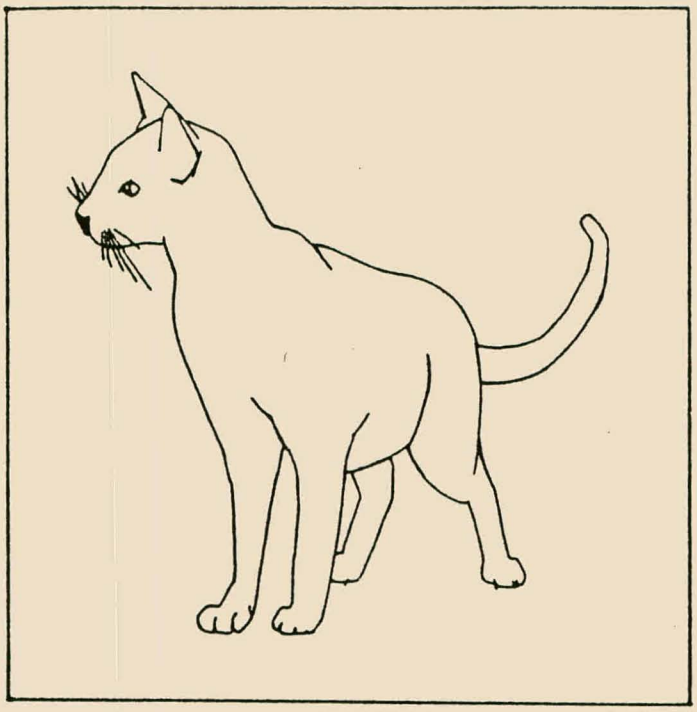


	1	2	3	4	5	6	7	
GOED	(1)	2	3	4	5	6	(7)	SLEG

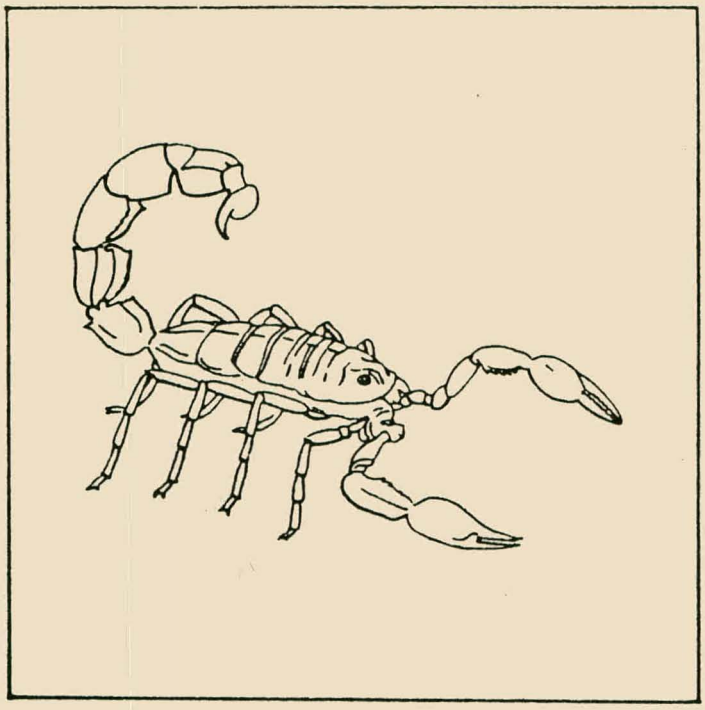
'n Sirkel in 7 dui aan dat die persoon nie baie van haaie hou nie

'n Sirkel in 1 sou aandui dat die persoon baie van dié diere hou.

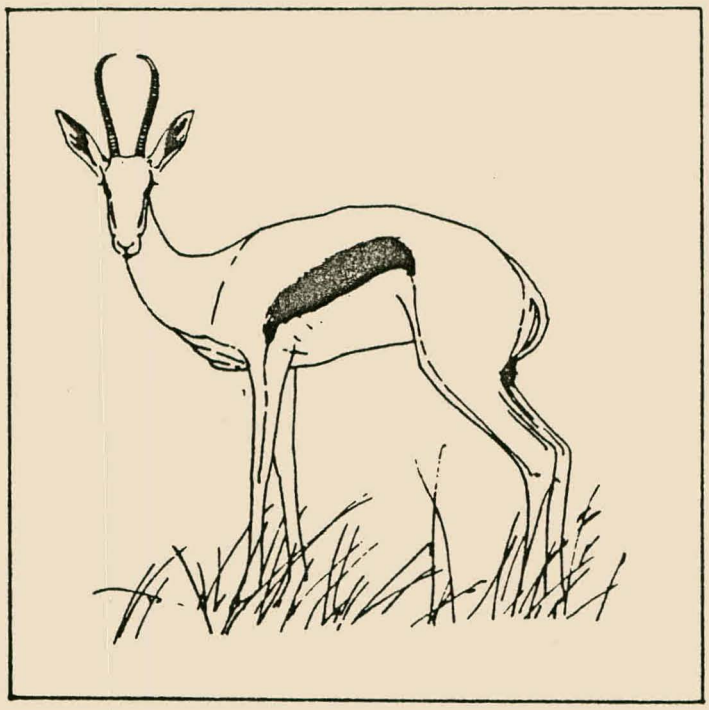
Probeer nou bladsye 12-21 Beantwoord ALLE woordpare.



Aangenaam	1 2 3 4 5 6 7	Onaangenaam	61
Sleg	1 2 3 4 5 6 7	Goed	62
Donker	1 2 3 4 5 6 7	Helder	63
Mooi	1 2 3 4 5 6 7	Lelik	64
Skoon	1 2 3 4 5 6 7	Vuil	65



Aangenaam	1 2 3 4 5 6 7	Onaangenaam	66
Sleg	1 2 3 4 5 6 7	Goed	67
Donker	1 2 3 4 5 6 7	Helder	68
Mooi	1 2 3 4 5 6 7	Lelik	69
Skoon	1 2 3 4 5 6 7	Vuil	70



Aangenaam	1 2 3 4 5 6 7	Onaangenaam	71
Sleg	1 2 3 4 5 6 7	Goed	72
Donker	1 2 3 4 5 6 7	Helder	73
Mooi	1 2 3 4 5 6 7	Lelik	74
Skoon	1 2 3 4 5 6 7	Vuil	75

Aangenaam	1	2	3	4	5	6	7	Onaangenaam	76
Sleg	1	2	3	4	5	6	7	Goed	77
Donker	1	2	3	4	5	6	7	Helder	78
Mooi	1	2	3	4	5	6	7	Lelik	79
Skoon	1	2	3	4	5	6	7	Vuil	80

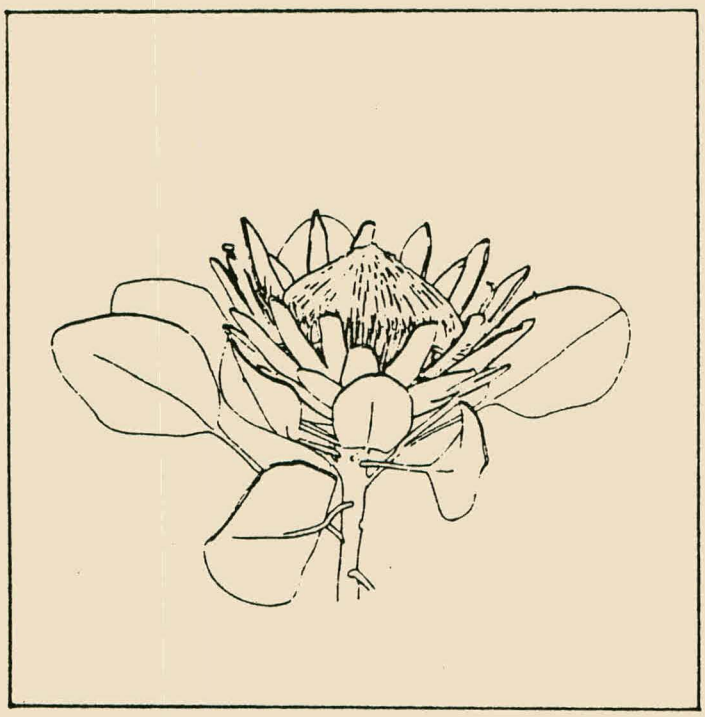
2	1

KAARTNO

2-4

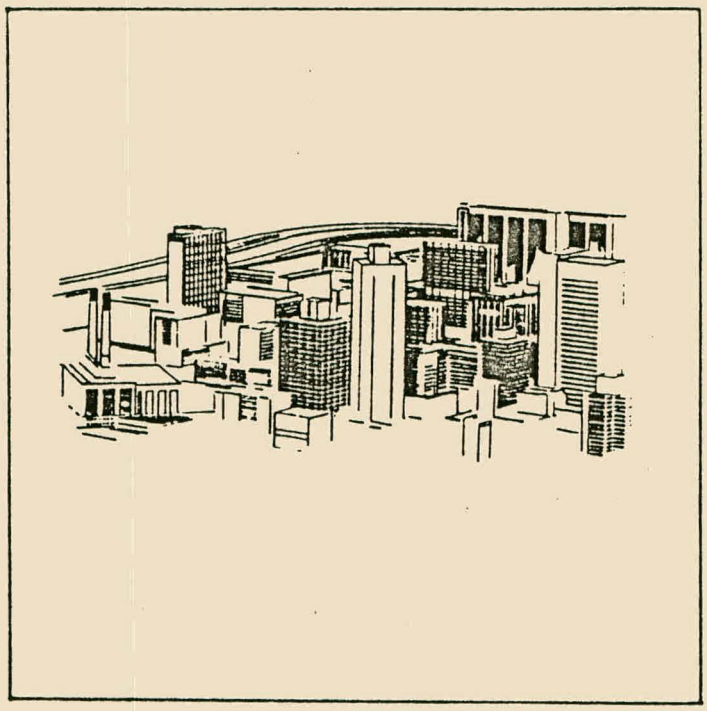
REKORD

Aangenaam	1	2	3	4	5	6	7	Onaangenaam	5
Sleg	1	2	3	4	5	6	7	Goed	6
Donker	1	2	3	4	5	6	7	Helder	7
Mooi	1	2	3	4	5	6	7	Lelik	8
Skoon	1	2	3	4	5	6	7	Vuil	9

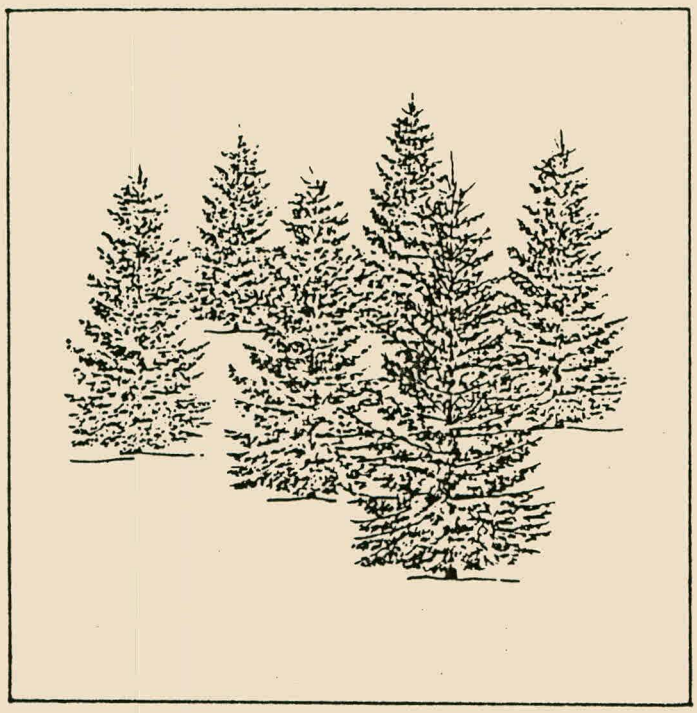


Aangenaam	1 2 3 4 5 6 7	Onaangenaam	10
Sleg	1 2 3 4 5 6 7	Goed	11
Donker	1 2 3 4 5 6 7	Helder	12
Mooi	1 2 3 4 5 6 7	Lelik	13
Skoon	1 2 3 4 5 6 7	Vuil	14

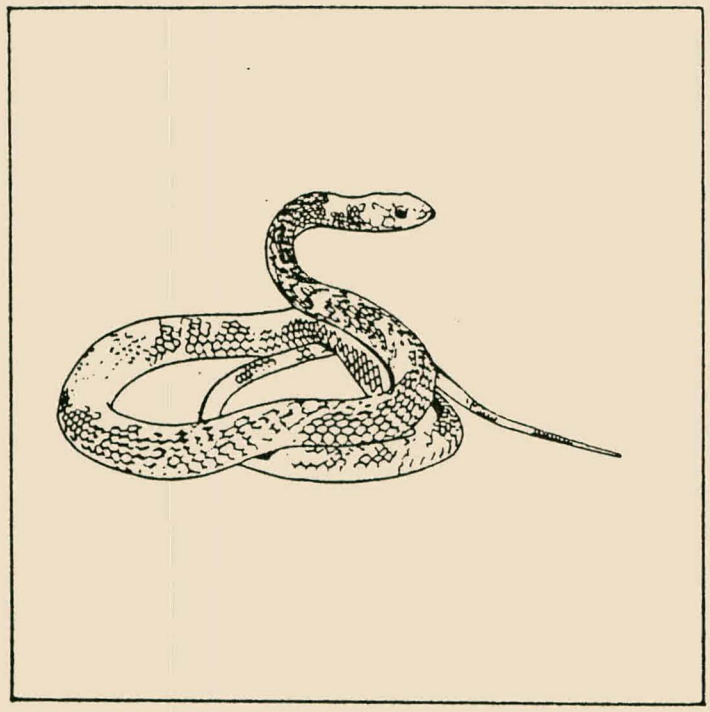
Aangenaam	1 2 3 4 5 6 7	Onaangenaam	15
Sleg	1 2 3 4 5 6 7	Goed	16
Donker	1 2 3 4 5 6 7	Helder	17
Mooi	1 2 3 4 5 6 7	Lelik	18
Skoon	1 2 3 4 5 6 7	Vuil	19



Aangenaam	1	2	3	4	5	6	7	Onaangenaam	20
Sleg	1	2	3	4	5	6	7	Goed	21
Donker	1	2	3	4	5	6	7	Helder	22
Mooi	1	2	3	4	5	6	7	Lelik	23
Skoon	1	2	3	4	5	6	7	Vuil	24



Aangenaam	1 2 3 4 5 6 7	Onaangenaam	25
Sleg	1 2 3 4 5 6 7	Goed	26
Donker	1 2 3 4 5 6 7	Helder	27
Mooi	1 2 3 4 5 6 7	Lelik	28
Skoon	1 2 3 4 5 6 7	Vuil	29



Aangenaam	1 2 3 4 5 6 7	Onaangenaam	30
Sleg	1 2 3 4 5 6 7	Goed	31
Donker	1 2 3 4 5 6 7	Helder	32
Mooi	1 2 3 4 5 6 7	Lelik	33
Skoon	1 2 3 4 5 6 7	Vuil	34

35 – 36

AFDELING C

Aktiwiteite

Reageer eerlik deur die betrokke letter a, b of c by elke stelling hieronder te omkring.

		Doen dit	Het nog nie, maar sal graag	Stel nie belang nie		
1.	Gaan graag visvang	a	b	c		37
2.	Hou voëls (of wilde diere) dop	a	b	c		38
3.	Gaan stap in die veld	a	b	c		39
4.	Behoort aan 'n natuurlewevereniging	a	b	c		40
5.	Lees graag oor diere en plante	a	b	c		41
6.	Voer voëltjies (of wilde diere)	a	b	c		42
7.	Bestel publikasies van Natuurbewaring	a	b	c		43
8.	Maak projekte oor Natuurbewaring	a	b	c		44
9.	Maak piekniek in die veld	a	b	c		45
10.	Help rommel opruim	a	b	c		46
11.	Bespaar baie water en elektrisiteit	a	b	c		47
12.	Verduidelik natuurverskynsels aan die familie	a	b	c		48
13.	Kyk graag natuurfilms of -videos	a	b	c		49
14.	Besoek graag natuurreservate	a	b	c		50
15.	Versamel graag interessante diertjies/plantjies	a	b	c		51
16.	Slaap buite in die veld	a	b	c		52
17.	Verkies herbruikbare materiaal	a	b	c		53
18.	Lewer 'n aktiewe bydrae tot die bewaring van die natuur	a	b	c		54

55-56

APPENDIX A-2

READ THROUGH THE FOLLOWING INSTRUCTIONS CAREFULLY

EIGHT transparencies will be shown on the screen without any commentary. You will have to observe carefully and write down your honest responses to each image. The questions are numbered so as to correspond with the numbers of the transparencies.

N.B. 1. There is no way in which you can be identified.

2. There are no right or wrong answers; your honest opinion is of importance.

3. The first and second part of each question are answered by means of a short sentence written in the space provided; the third part is answered by circling an appropriate number on a scale, e.g.

EXAMPLE

How do you feel about the future?

OPTIMISTIC	1	2	3	4	5	6	7	PESSIMISTIC

If you feel somewhat pessimistic, the 5 or 6 will be encircled; if you feel very optimistic, the 1 will be encircled.

PERSONAL PARTICULARS

OFFICE USE

1 Card no.

2 - 4 Record

5

1. SEX

MALE	1
FEMALE	2

2. AGE

18 - 20	1
20 - 22	2
22 - 24	3
24 +	4

6

3. MATRICULATION SUBJECTS: MARK THOSE SUBJECTS TAKEN IN MATRIC

BIOLOGY	1
PHYS-CHEM	2
GEOGRAPHY	3
ECONOMY	4
AGRIC.SCIENCE	5
MATHEMATICS	6
DOMESTIC SCIENCE	7
ART	8
HISTORY	9

7
8
9
10
11
12
13
14
15

4. HOME LANGUAGE

ENGLISH	1
AFRIKAANS	2
OTHER	3

16
17
18

5. WHERE DID YOU GROW UP?

CITY	1
TOWN	2
FARM	3

19
20
21

TRANSPARENCY 1

OFFICE USE

1.1 What do you see?

.....

.....

21 - 22

1.2 What do you think of it?

.....

.....

23 - 24

25 - 26

1.3 How do you feel about it?

not worried	1	2	3	4	5	6	7	worried
dark	1	2	3	4	5	6	7	bright
threatened	1	2	3	4	5	6	7	safe
optimistic	1	2	3	4	5	6	7	pessimistic

27

28

29

30

31 - 32

TRANSPARENCY 2

2.1 What does it mean?

.....

.....

33 - 34

2.2 What do you think of it?

.....

.....

35 - 36

2.3 How do you feel about it?

amazed	1	2	3	4	5	6	7	indifferent
informed	1	2	3	4	5	6	7	ignorant
optimistic	1	2	3	4	5	6	7	pessimistic

39

40

41

42 - 43

TRANSPARENCY 3

OFFICE USE

3.1 What do you see?

.....

.....

44 - 45

3.2 What do you think of it?

.....

.....

46 - 47

48 - 49

3.3 How do you feel about it?

excited	1	2	3	4	5	6	7	bored
responsible	1	2	3	4	5	6	7	irresponsible
unconcerned	1	2	3	4	5	6	7	concerned
astonished	1	2	3	4	5	6	7	indifferent

50

51

52

53

54 - 55

TRANSPARENCY 4

4.1 What do you see?

.....

.....

56 - 57

4.2 What do you think of it?

.....

.....

58 - 59

60- 61

4.3 How do you feel about it?

bitter	1	2	3	4	5	6	7	sweet
negative	1	2	3	4	5	6	7	positive
not worried	1	2	3	4	5	6	7	worried
sympathetic	1	2	3	4	5	6	7	unsympathetic

62

63

64

65

66 - 67

TRANSPARENCY 5

OFFICE USE

5.1 What do you see?

.....

.....

68 - 69

5.2 What do you think of it?

.....

.....

70 - 71

72 - 73

5.3 How do you feel about it?

worried	1	2	3	4	5	6	7	not worried
satisfied	1	2	3	4	5	6	7	unsatisfied
guilty	1	2	3	4	5	6	7	innocent
happy	1	2	3	4	5	6	7	sad

74

75

76

77

78 - 79

2 Kaartno.

Rekord

TRANSPARENCY 6

6.1 What do you see?

.....

.....

5 - 6

6.2 What do you think of it?

.....

.....

7 - 8

9 - 10

4.3 How do you feel about it?

pleasant	1	2	3	4	5	6	7	unpleasant
perturbed	1	2	3	4	5	6	7	unperturbed
proud	1	2	3	4	5	6	7	ashamed
threatened	1	2	3	4	5	6	7	safe

11

12

13

14

15 - 16

TRANSPARENCY 7

OFFICE USE

7.1 What do you see?

.....

.....

17 - 18

7.2 What do you think of it?

.....

.....

19 - 20

21 - 22

7.3 How do you feel about it?

involved	1	2	3	4	5	6	7	uninvolved
burdened	1	2	3	4	5	6	7	relieved
dark	1	2	3	4	5	6	7	bright
guilty	1	2	3	4	5	6	7	not guilty

23

24

25

26

27 - 28

TRANSPARENCY 8

8.1 What do you see?

.....

.....

29 - 30

8.2 What do you think of it?

.....

.....

31 - 32

33 - 34

35

36

37

38

39 - 40

8.3 How do you feel about it?

touched	1	2	3	4	5	6	7	untouched
upset	1	2	3	4	5	6	7	calm
guilty	1	2	3	4	5	6	7	not guilty
happy	1	2	3	4	5	6	7	sad

9. Write a short paragraph explaining how the eight concepts shown are related.

.....

.....

.....

.....

.....

.....

OFFICE USE

	41 - 42
	43 - 44
	45-47
TOT. P	
	48-50
TOT. H	

APPENDIX A-3

TABLE OF RESULTS OF THE INVESTIGATION OF STUDENT PERCEPTIONS TOWARD THE ENVIRONMENT AND CONSERVATION

MEANS	Cogn.	Att.	Perc. 1	Feel	Perc. 2
PLANET EARTH	1,94 38,80	1,16 23,20	31,03	2,76 2,73 2,62 2,69	38,91
RESOURCES	0,73 14,60	1,55 31,00	22,84	4,66 4,52 3,44 *	60,90
FYNBOS	1,14 22,80	1,29 25,80	24,41	5,96 5,85 4,11 * 5,75	78,03
DEFORESTATION	2,71 54,20	2,11 42,20	48,15	5,80 5,66 5,67 2,94 *	72,10
POLLUTION	2,51 50,20	2,36 47,20	48,80	6,70 6,50 4,06 * 6,48	85,40
DESERTIFICATION	0,89 17,80	1,24 24,80	21,18	5,74 5,29 5,21 4,56 *	74,94
END. SPECIES	1,56 31,20	2,30 46,00	38,82	4,19 5,66 5,59 3,83 *	69,77
MALNUTRITION	2,59 51,80	2,10 42,00	46,62	5,96 5,22 4,04 * 6,20	77,32

MEAN MARKS IN THE CATEGORIES COGNITIONS, ATTITUDES, PERCEPTIONS 1, FEEL AND PERCEPTIONS 2.

Perceptions 1 is made up by the totals of Cognitions and Attitude mean marks; the marks in the "feel" column represent the individual marks for semantic differential items; the Perception 2 marks are the means of the semantic differential (feel) marks, expressed as a percentage.

APPENDIX A-4

READ THESE INSTRUCTIONS CAREFULLY BEFORE YOU START

There are two kinds of questions in this questionnaire:

1. To answer the first kind you have to fill in your answer on the dotted line in the given space, e.g.:

   How old are you? ..15. years

2. For the other kind, a few possible answers are given. Opposite each one is a number. Please encircle the number of the answer which is closest to what you think, e.g.:

   What is your favourite colour?

Blue	1
Red	(2)
Yellow	3
Green	4
Other	5

   If red is your favourite colour, encircle the 2 as shown.

NB. There are no right or wrong answers in this questionnaire. We are only interested in **your honest opinion.**

For office use only

		4
		6

1. How old are you?

..... years	7

2. In what standard are you?

std.....	8

3. What is your sex?

male	1	
female	2	9

4. Which language do you speak at home most often?

Afrikaans	1	
English	2	
Xhosa	3	
Other ..... (specify)	4	10

5. What do you think of when your hear an S.O.S.?

....	12

6. How often do you listen to pop music?

Regularly	1	
Sometimes	2	
Never	3	13

6.1 If "never", why not?

....	15

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7. Do you normally listen to the words of a song?

Yes, always	1
Yes, sometimes	2
No, never	3

☐ 16

8. How important is wildlife to you?

Very important	1
Important	2
Not really important	3
Not important at all	4

☐ 17

9. Are there any plant species about which you feel worried?

Yes	1
No	2

☐ 18

9.1 If "yes" which one(-s)?

.....

.....

☐☐ 20

10. Are there any animal species about which you feel worried?

Yes	1
No	2

☐ 21

10.1 If "yes", which one(-s)?

.....

.....

☐☐ 23

11. Can you think of things that humans do that endanger wildlife?

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Yes	1
No	2

[ ] 24

11.1 If "yes", what can you think of?

.....

.....

.....

.....

.....

.....

[ ][ ] 26

12. What do you think of when you look at each of the following pictures?

12.1

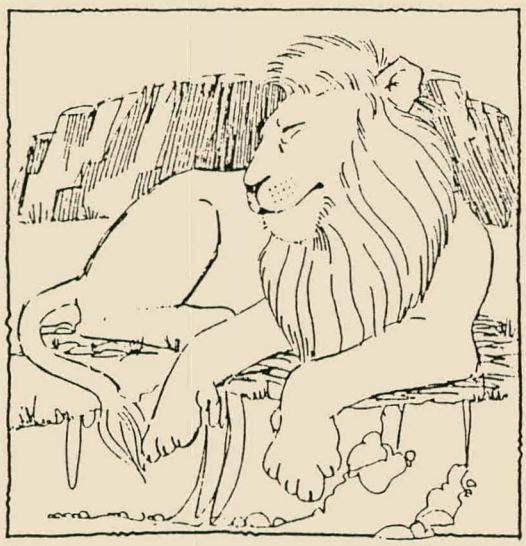
.....

.....

.....

[ ][ ] 28

12.2



.....

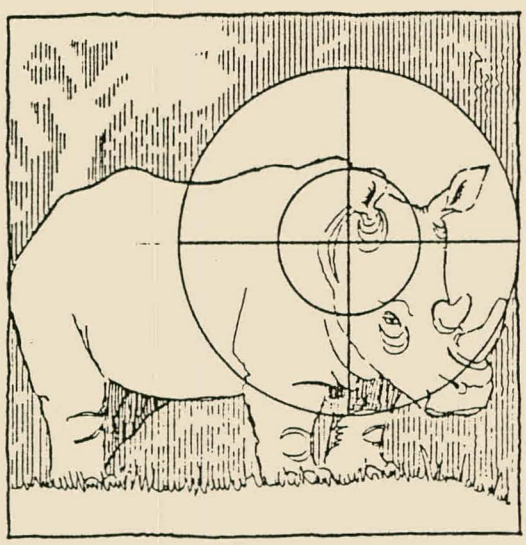
.....

.....

For office use only

30

12.3



.....

.....

.....

32

12.4

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.....

.....

.....

34

13. Think about wildlife in Southern Africa and then complete each of the following sentences:

13.1 I **like** .....

.....

13.2 I **feel** .....

.....

13.3 I **want to** .....

.....

36

38

40

For office use only

14. Indicate about which of the following topics you would like to find out more:

What I can do to conserve nature	1	41
Endangered plant and animal species	2	42
Soil and water conservation	3	43
Deforestation	4	44
Nature conservation	5	45
Zoos	6	46
Balance in nature	7	47
		48

15. In what way do you prefer to find out more about a topic? (Encircle one only.)

Watch television programmes about it	1	
Read about it	2	
Ask parents/teachers/someone who knows	3	49

APPENDIX B-1

AFDELING/*SECTION C*

Lees elke stelling hieronder en trek dan 'n kring om a,b of c teenoor elke stelling./*Read the statements carefully, and circle the a,b or c opposite each statement.*

Slegs vir kantoorgeb
For office only

2 1

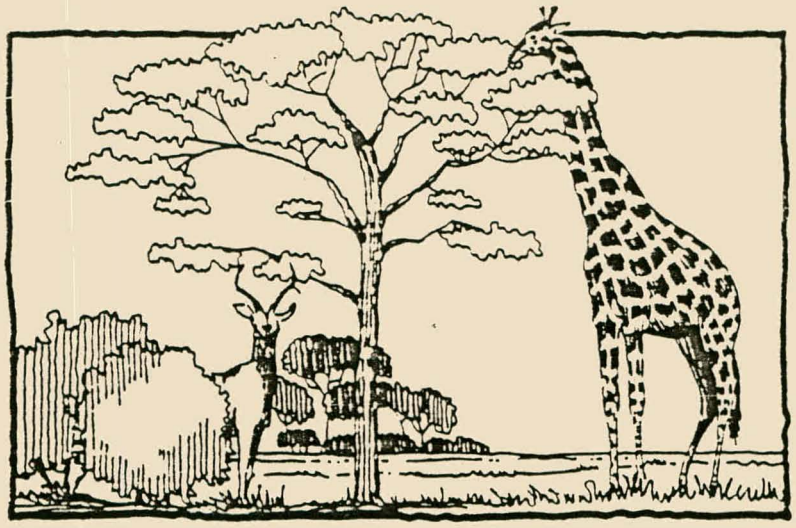
2

		Ek doen dit/*I do (or have done) this*	Ek het nog nie, maar wil graag/*I have not, but want to*	Ek wil dit nie doen nie/*I do not want to do this*		
1.	Pluk graag veldblomme/*Like to pick wild flowers*	a	b	c		5
2.	Gee voëltjies (of wilde diere) kos/*Feed birds (or wild animals)*	a	b	c		6
3.	Stap graag in die veld/*Go walking in the veld*	a	b	c		7
4.	Bestel boeke/prente/plakkate oor die natuur *Order books/posters/pictures about nature*	a	b	c		8
5.	Lees graag oor wilde plante en diere *Read about wild plants or animals*	a	b	c		9
6.	Maak projekte of temas oor die natuur. *Do project work about nature*	a	b	c		10
7.	Help om rommel op te tel/*Help cleaning up litter*	a	b	c		11
8.	Vat aan wilde diere/*Touch wild animals*	a	b	c		12
9.	Besoek natuurreservate/*Visit nature reserves*	a	b	c		13
10.	Kyk graag na TV-programme soos 50/50. *Like watching TV-programmes like 50/50*	a	b	c		14
11.	Help graag beseerde of siek voëltjies/*Help injured or sick birds*	a	b	c		15
12.	Bespaar water en elektrisiteit/*Save water and electricity*	a	b	c		16
13.	Verduidelik natuurverskynsels aan familie *Explain nature to family*	a	b	c		17
14.	Roei miere, vlieë, spinnekoppe uit *Exterminate flies, ants and spiders*	a	b	c		18
15.	Kap vreemde indringerbome af of trek dit uit *Pull out or chop down alien invader plants*	a	b	c		19
16.	Hou graag voëltjies/insekte/diere dop. *Like watching birds/insects/animals*	a	b	c		20
17.	Behoort aan verenigings soos Landsdiens, natuurlewevereniging, ens./*Join organizations like Wildlife Society, Boy Scouts, etc.*	a	b	c		21
18.	Teken in op tydskrifte soos Toktokkie, Custos, ens. *Subscribe to magazines like Toktokkie, Custos, etc.*	a	b	c		22

APPENDIX B-2

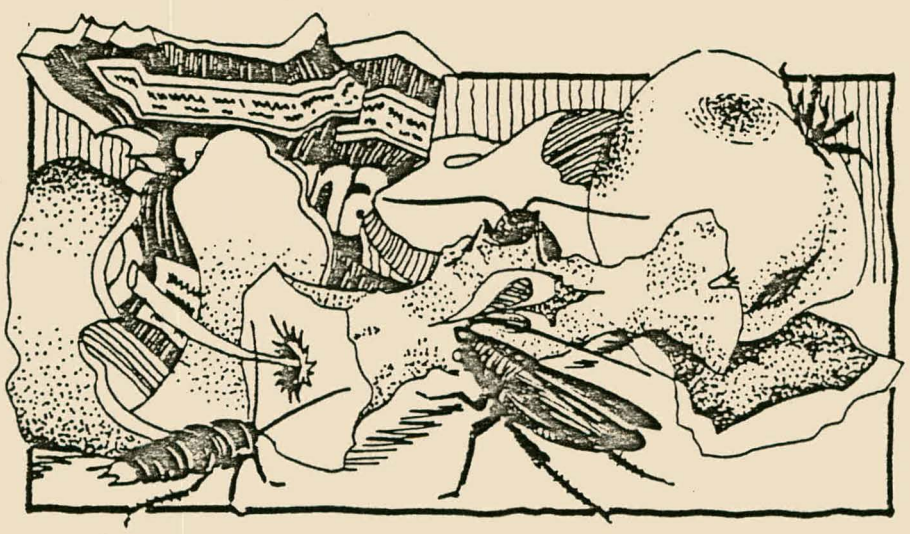
			REMARKS		
	RE-COG-NISE	SUIT-ABLE	POSITIVE	NEGATIVE	RECOMMEN-DATIONS
1. GIRAFFE-ADAPTATIONS	14,12				Analysis of emotions to be done
2. DECOMPOSERS: RUBBISH	1,1	X		Insects too inconspicious crowded attention drawn by rubble	
3. DESERT/TOO LITTLE WATER	51,9	?	Desert very effectively	Funny plants draws lots of attention	Plant less conspicious. Analysis emotion require
4. DEFORESTATION		?	Very high concern	Machine very conspicious - remove?	Remove machine more trunks
5. SOIL	6,7		Enough indications of recognition - value of soil		
6. ROLE OF PLANTS STRAWBERRY	11,2	?		Too cluttered - detain distracts	
7. ROLE OF FLIES DECOMP. (FISH)	5,9		Strong aversion (18,9%) suitable		Fish more defined
8. INVADERS (PINETREE)	6,3				More (smaller) pine trees growing underneath (+2)
9. LITTLE WATER (BRIDGE)	9,8	X		Distraction - bridge and river (20+%)	
10. DEPENDENCE	32,8			Happy people distracts	More prominence to sun and water
11. ROLE OF PLANTS (LIZARD)	16,4	?	Varied responses	Lizard very consp. proportions?	
12. FOOD CHAIN	21,1		Very suitable. High neg. emotion		
13. DROUGHT KAROO SCENE	57,9			Flowers? Rain?	Emotions needs to be analized - compared to 3.

14. FOOD CHAIN BIRD	6,5	?	Excellent emotions		Replace snails by worms/grubs
15. WATER	6,5			Very low recommendation of water	"Whirlpool" distracts
16. ROLE OF PLANTS APPLE TREE	24,0		Excellent picture. Very explicit		
17. SOIL EROSION	26,5		Well-depicted	Wind/storm distracts!	Neutral background/Sky
18. POLLUTION	25,4		Very clear - too explicit? Emotions (18,0)		
19. DECOMPOSER ROLE	15,0	?		Distracted by fact that too well-known .... is used	
20. ENDANGERED SPECIES	23,9				Concern needs to be analysed



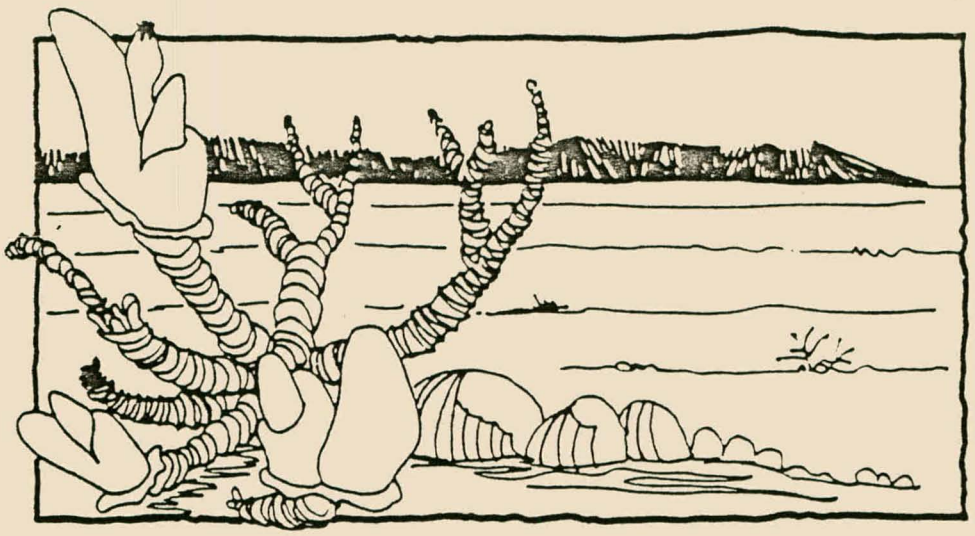
1

INDICATION OF ADAPTATIONS	14,12	CONSERVATION	11,90
NATIONAL GAME PARK	23,20	EATING	14,12
WILDLIFE (GEN)	25,40		



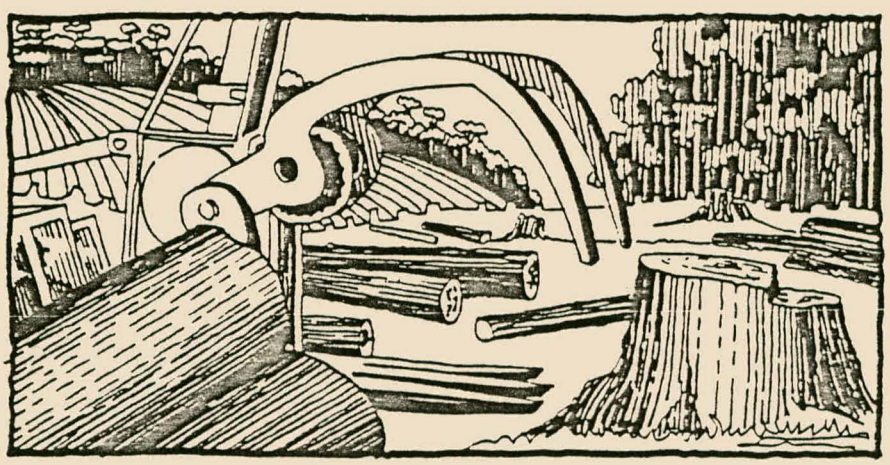
2

AVERSION	21,70	ANIMALS POISONED	4,80
ROLE OF INSECTS	1,10	POLLUTION LITTERING	4,20
DESCRIPTIVE	60,40		



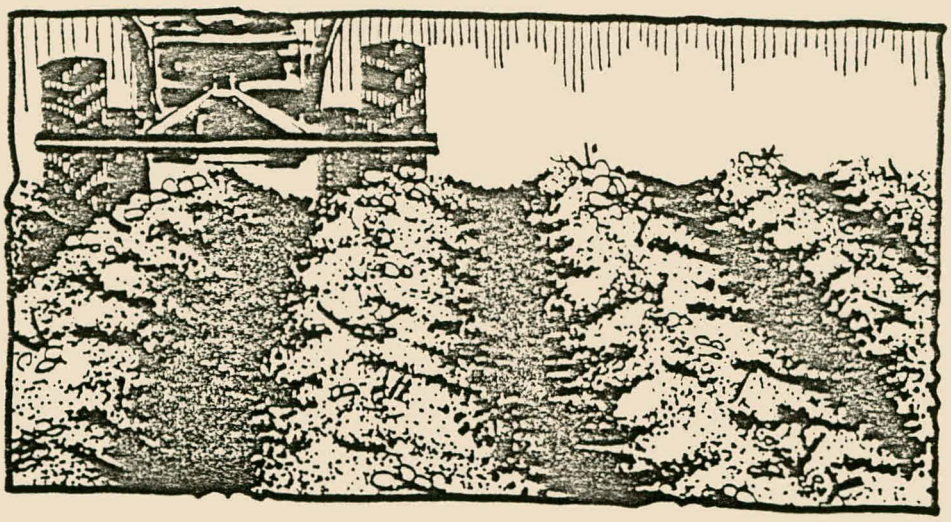
3

DESERT/DROUGHT	51,90	DESCRIPTIVE	3,90
DESOLATE	8,30	SUCCULENT	3,90
SEA/WATER	15,50	OTHER	16,60



4

DESCRIPTIVE	13,80	CONCERN	46,4
WOOD/FOREST CHOPPED	11,00	OTHER	6,6
UTILITARIAN	22,10		

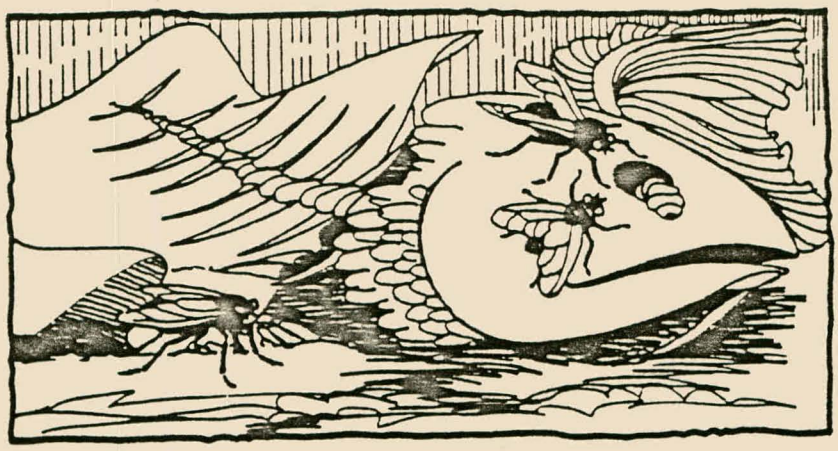


5

SOIL	6,70	FOOD/LIFE/FROM SOIL	17,30
PLOUGHING (DESCR.) HARVEST	61,30	OTHER	6,70
DESTRUCTION	8,00		

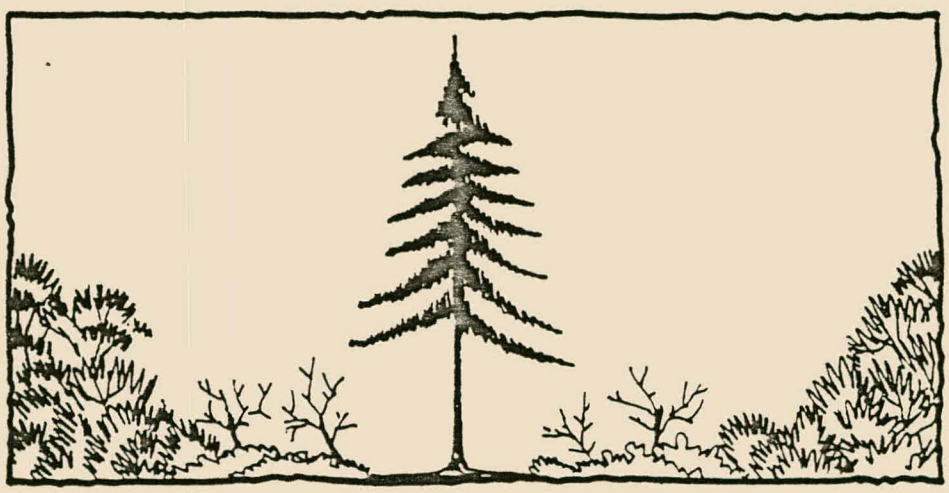
6

ROLE OF PLANTS	11,20	GARDEN	13,40
POLLINATION	4,50	EATING	19,50
AVERSION/DESTROY	12,80	DESCRIPTIVE	16,20
		FOCUS INSECTS	11,70
		OTHER	10,60



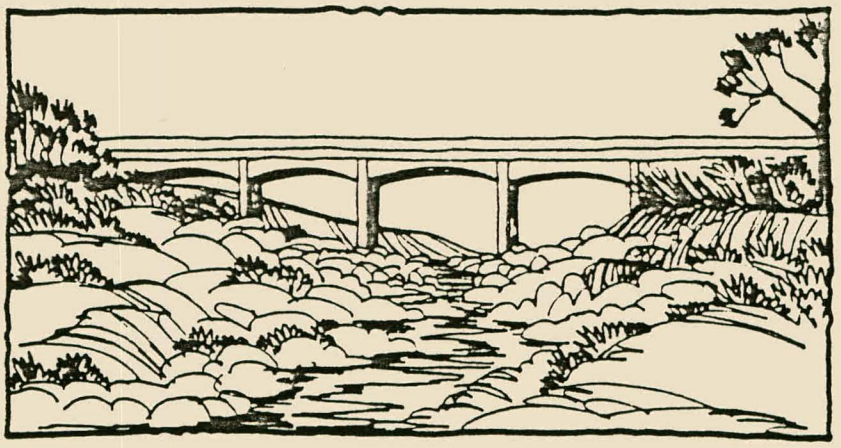
7

AVERSION	18,90	FLIES EATING (DESCRIPTIVE)	36,70
ROLE OF FLIES	5,90	FLIES	7,60
DESCRIPTIVE	16,60	OTHER	14,20



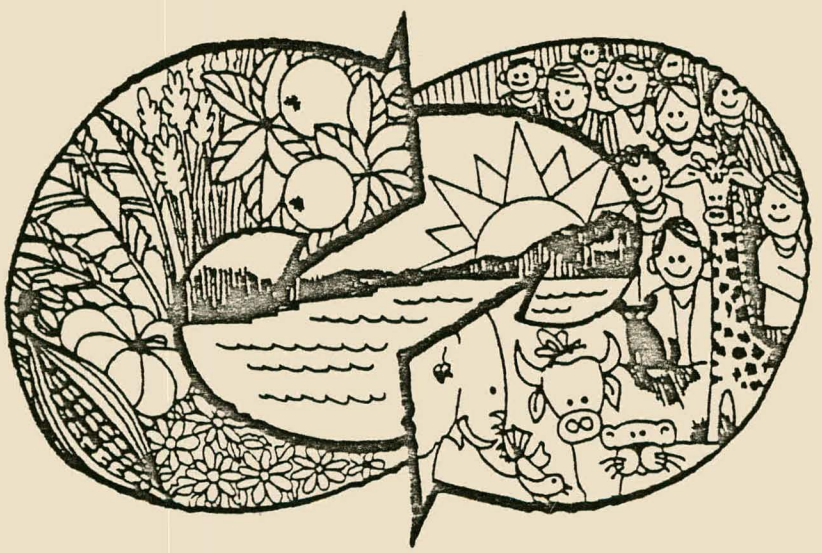
8

INVADERS	6,3	NATURE FOREST	21,5
"ONLY TREE"	35,6	PINE	11,2
BIG TALL	7,3	OTHER	18,0



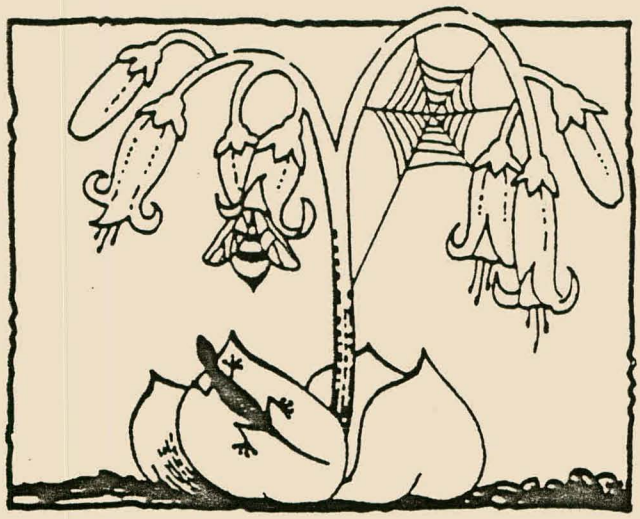
9

FOCUS BRIDGE	10,40	FOCUS BRIDGE/RIVER	30,00
DROUGHT/LITTLE WATER	9,20	NATURE	8,70
FOCUS RIVER	20,20	HUMAN INTERVENTION	10,90
DIVERSE	9,80		



10

DESCRIPTIVE	12,00	CYCLES	13,70
NATURE/LIFE	9,30	PEOPLE(HAPPINESS)	20,80
DEPENDENCE	32,80	OTHER	11,50

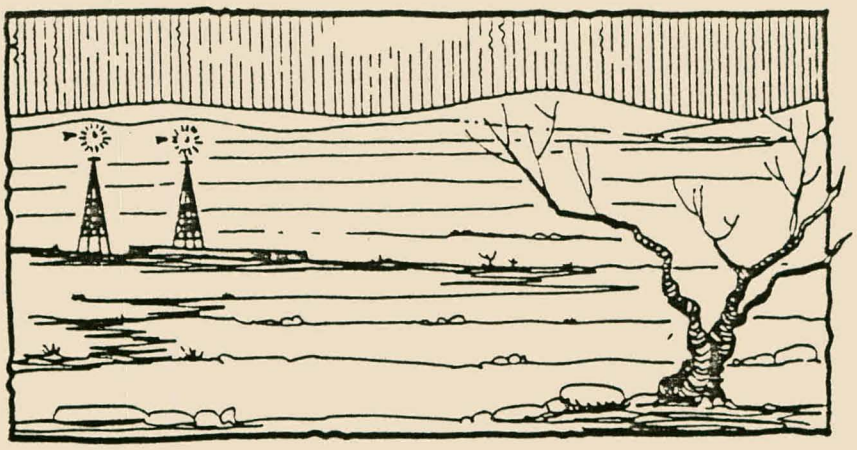


11

ROLE OF PLANTS	16,40	WILDLIFE/NATURE	14,20
FOCUS ON FLOWERS	7,10	ANIMALS EATING OTHERS	12,00
DESCRIPTIVE	18,60	FOCUS ON ONE ANIMAL	16,90
		OTHER	14,80

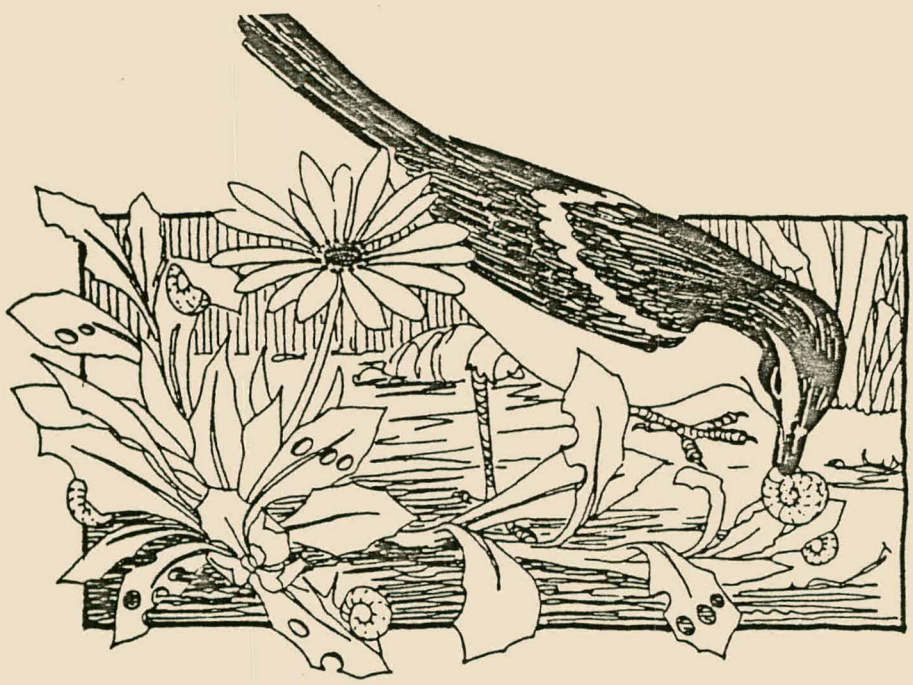
12

INDICATION OF FOOD CHAIN	21,10	NATURE	11,90
PREDATOR/PREY	30,10	DANGER	14,60
AVERSION/SYMPATHY	12,40	OTHER	8,10



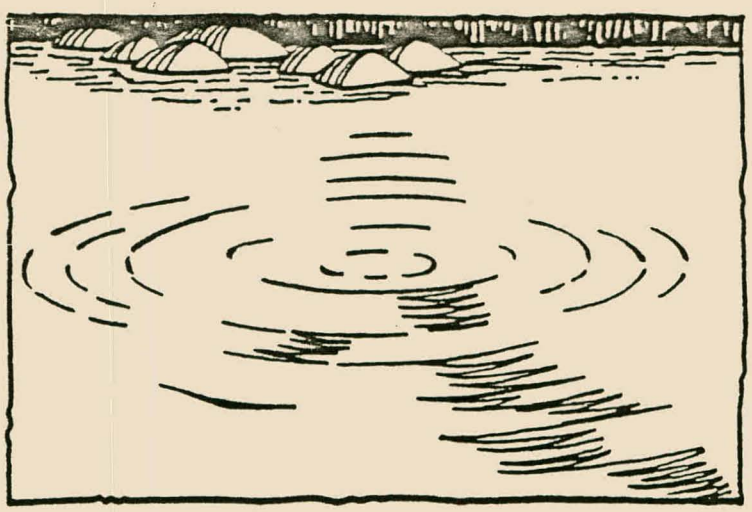
13

DROUGHT	57,90	SWAMP/RIVER/FLOOD	2,70
RAIN	3,30	DESCRIPTIVE/FARM	12,50
DESOLATE	13,70	WINTER	4,40
		OTHER	5,50



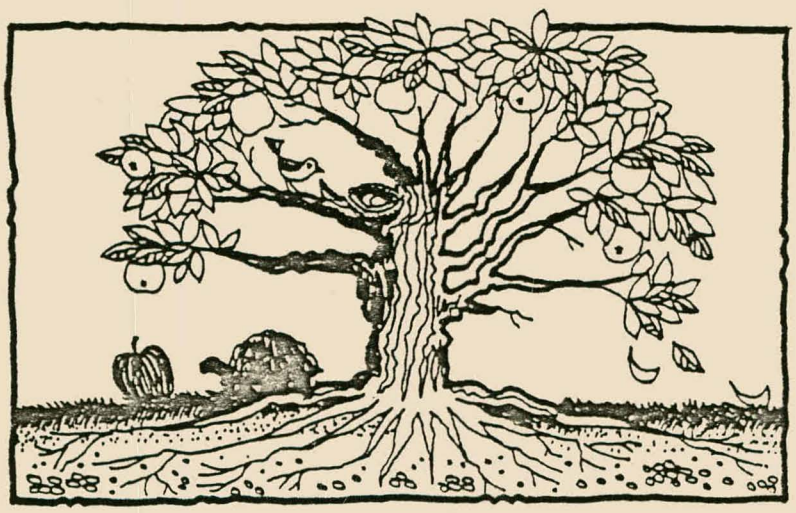
14

FOOD-RELATIVE	6,50	DESCRIPTIVE	7,00
NATURE	22,70	OTHER	14,60
BIRD THAT EATS	51,90		



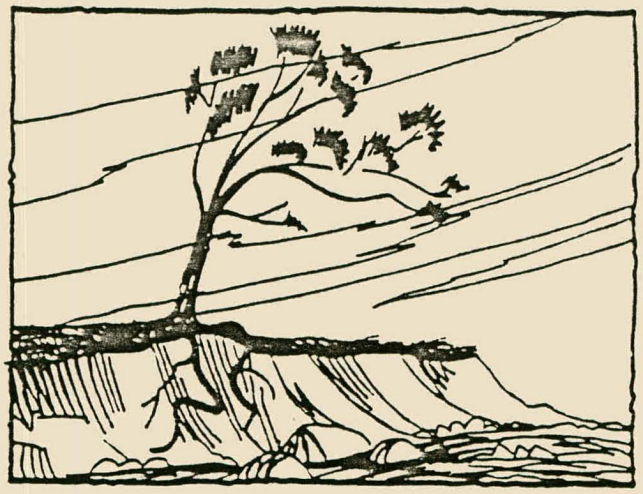
15

WHIRLPOOL	16,10	STONE(CIRCLES)	45,20
"DANGER"	2,20	WATER	6,50
POOL/RIVER/DAM	12,40	OTHER	17,70



16

ROLE OF TREES	24,00	FOCUS BIRD	5,60
DESCRIPTIVE (GENERAL)	20,70	FOCUS TURTLE	1,70
DESCRIPTIVE (TREE/FRUIT)	24,60	OTHER	23,50

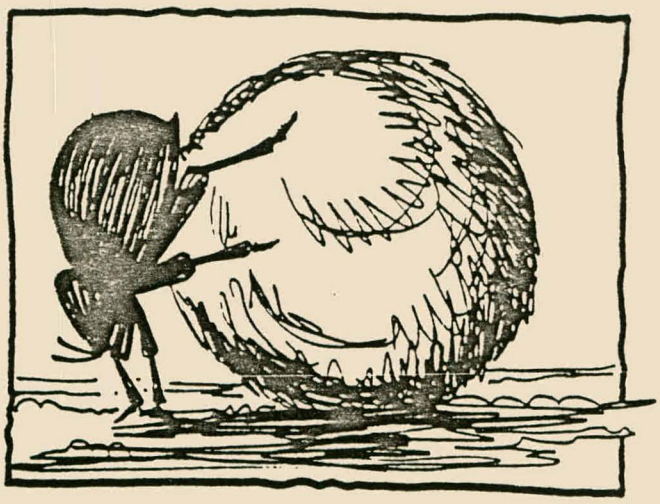


17

SOIL EROSION	26,50	FOCUS ON TREE/ROOTS	5,90
WIND/STORM	47,60	OTHER	12,40
RIVER/SEA/FOOD	7,60		

18

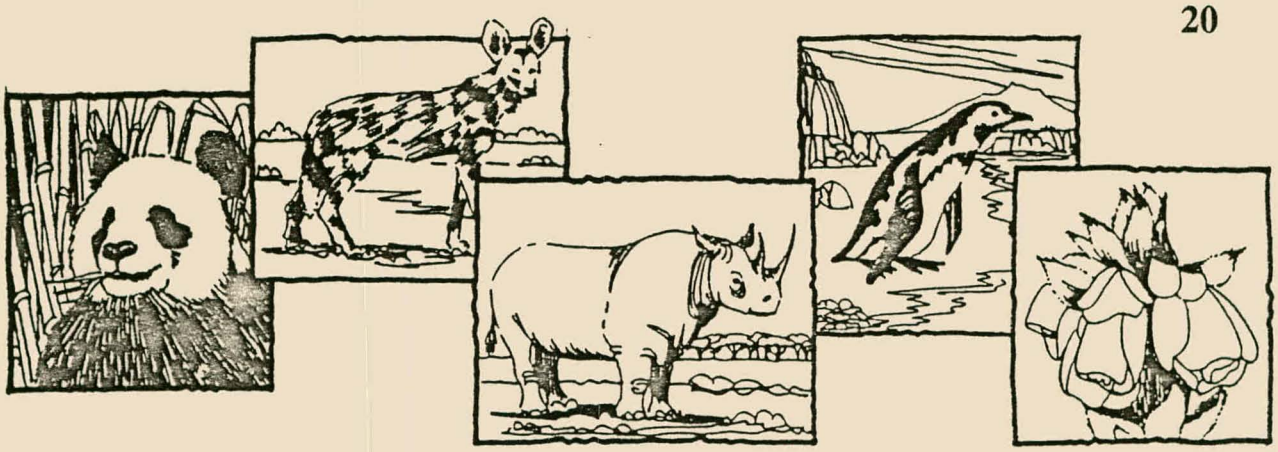
POLLUTION	25,40	POLLUTION CONSEQUENCES	15,50
POLLUTION WATER	24,80	POLLUTION - CONCERN	18,20
POLLUTION WATER/AIR	9,90	OTHER	6,10



19

RECOGNISE DUNG BEETLE	44,80	OTHER	29,50
DESCRIBES ROLE	15,30		
DO NOT RECOGNISE	10,40		

20



ENDANGERED SPECIES	23,90	OTHER	7,6
WILDLIFE/CONSERVATION	66,30		
ZOO	2,20		

APPENDIX B-3

CONCEPT		COGNITIVE	AFFECTIVE
SOIL	3	Valuable natural resources; non-renewable	Concern, care
	2	Mother Earth; precious soil, dependency	Dependency (4/6)
	1	Soil; fertile soil; new life from tilling land; cultivation	Don't ruin soil; food production from soil
	0	Ploughing, planting, harvesting	
WATER	3	Natural resource	Care for, manage carefully
	2	Precious water; Useful life-sustaining;	Dependency (4/6); values water dependency (4/6); Importance
	1	Water (in dam, river). Name some uses; don't pollute	Human uses; usable water, clean, don't pollute
	0	Whirlpool, river, dam	Throw stone in...
DROUGHT	3	Water shortage; generalize effects (e.g. soil erosion)	Strong concern for life (animal & plant); reasons
	2	Too little water, needs rain; no life as result of drought	Concern; worried
	1	Dry, desert, Karoo barren, no plants	Feel sorry; sad; feel bad
	0	Windmills; desolation	
DEPENDANCY ON NATURAL RESOURCES	3	Dependency on sun, soil water (any 2)	Wonderment, awe
	2	Importance of sun as source of energy; or importance of water	Feel grateful for sun or water
	1	Sun as source of light or heat	Happy (qualified); expression of dependency
ADAPTATIONS	3	Adapted to; camouflage; niche	Wonderment, amazed
	2	Any indication of adaption	Creation; way it should be
	1	Giraffe taller than buck; recognition of defferent sizes	Feel good, happy (with reference to adaption)

DECOMPOSERS	3	Important function of decomposers	Wonderment, amazement, respect
	2	Natural cycles; food chain; decomposition, keep nature clean	Feel good regarding role of flies
	1	Flies eat dead fish	Shows no aversion; the way of nature
	0		Cross people litter
ROLE OF TREES	3	Important tole in ecosystem	Admiration for trees
	2	Useful-name functions e.g. shelter, food (3/6); expres dependency on trees	Concern for trees and animals sheltering in trees; should not be chopped
	1	Describing one function of trees; useful/needed; should plant more	Happy for animals' home and food; like trees
FOOD CHAINS	3	Bird-worm-plant-relationship; food chain	Understanding; wonderment
	2	Control of worms; part of the ecosystem	Importance of food chains
	1	Bird/worm find food; happy (control)	Happy for bird/worm
SOIL EROSION	3	Erosion due to mismanagement	Upset over cause (aversion, anger)
	2	Soil erosion (recognition	Must be stopped; concern for land; worried
	1	No soil to hold tree	Unhappy; sad; bad; concern for tree (no soil)
	0	Drought; wind; tree about to fall	
POLLUTION	3	General effects of pollution; Human role in destruction of environment	Concern for nature/life aversion over cause
	2	Man pollutes; some effects-animals/plants destroyed; destruction	Concern for effects on life; cross with human cause; should be prevented; shame
	1	Pollution; people litter; waste; dirty river	Sad; teriible; disgusting; unhealthy

DEFORESTATION	3	Effects- destroy animal habitats, oxygen, erosion, removal of plant cover, human role	Strong concern for conservation of forests
	2	Destroying nature (4/6); forests cut down	Sad/cross at destruction of nature; should replant; will soon have no trees
	1	Trees chopped down; utilization of wood; clearing of land	Unhappy, cross, ruin landscape
INVADER PLANTS	3	Invaders threatening indigenous vegetation	Something should be done; eradicate aliens, replant indigenous
	2	Alien/exotic plants; recognize invaders	Eradicate invaders; concern
	1	Notice dead plants	Sad for indigenous plants
	0	Fire; pine tree	
ENDANGERED SPECIES	3	Humans responsible for endangered species	Strong concern - human cause
	2	Endangered species; becoming extinct; scarce plants and animals	Save them; protect them Very upset over endangered species
	1	Animals are dying no - recognition of endangered species	Care for animals and plants

APPENDIX B-4(a)

	COGNITIONS									VALUES								
	FREQUENCIES OF CODES									FREQUENCIES OF CODES								
	0		1		2		3		MEAN	0		1		2		3		MEAN
	N	%	N	%	N	%	N	%	SCORE	N	%	N	%	N	%	N	%	SCORE
SOIL	515	84,3	71	11,6	25	4,1	-	-	0,198	491	80,4	111	18,2	9	1,5	-	-	0,211
WATER	418	68,4	123	20,1	70	11,5	-	-	0,430	428	70,0	132	21,6	51	8,3	-	-	0,383
DROUGHT	292	47,8	204	33,4	111	18,2	4	0,7	0,717	460	75,3	123	20,1	26	4,6	2	0,3	0,296
DEPENDENCY	282	46,2	66	10,8	181	29,6	82	13,4	1,103	443	72,5	157	25,7	11	1,8	-	-	0,293
ADAPTATIONS	539	88,2	30	4,9	28	4,6	14	2,3	0,209	596	97,6	10	1,6	4	0,7	1	0,2	0,034
DECOMPOSERS	364	59,6	228	37,3	14	2,3	5	0,8	0,444	544	88,4	62	10,1	5	0,8	-	-	0,118
ROLE OF TREES	312	51,1	216	35,4	79	12,9	4	0,7	0,632	454	74,3	134	21,9	22	3,6	1	0,2	0,296
FOOD CHAINS	70	11,4	385	63,0	87	14,3	69	11,3	1,254	333	54,5	257	42,1	20	3,3	1	0,2	0,491
EROSION	452	74,0	25	4,1	128	21,0	6	1,0	0,489	503	82,4	74	12,1	31	5,1	3	0,5	0,237
POLLUTION	115	18,8	366	59,9	127	20,8	3	0,5	1,029	155	25,4	350	57,3	106	17,3	-	-	0,920
DEFORESTATION	87	14,2	335	54,8	146	23,9	43	7,0	1,237	305	49,9	204	33,4	101	16,6	1	0,2	0,669
PLANT INVADERS	587	96,1	5	0,8	11	1,8	8	1,3	0,083	597	97,7	8	1,3	6	1,0	-	-	0,033
ENDANGERED SPECIES	480	78,5	9	1,5	113	18,5	9	1,5	0,429	438	71,6	91	14,9	81	13,3	1	0,2	0,419

FREQUENCIES OF CODES AND MEAN SCORES FOR COGNITIONS AND VALUES IN THE PRE-TEST FOR THE WHOLE TEST-GROUP (N=611)

APPENDIX B-4(b)

SCHOOL NO	1	2	3	4	5	6	7	8	9	10	11
SOIL	0,28	0,17	0,22	0,67	0,26	0,26	0,21	0,43	0,69	0,29	0,52
WATER	0,23	0,38	0,35	1,75	0,30	0,23	0,27	2,30	0,56	0,15	0,27
DROUGHT	1,11	1,09	1,35	0,55	1,07	1,48	1,22	0,41	1,56	1,38	0,95
DEPENDENCY	2,11	1,94	0,91	0,98	1,78	2,29	1,30	0,63	1,89	1,32	1,11
ADAPTATIONS	0,26	0,28	0,17	0,27	0,28	0,26	0,03	0,12	0,22	0,88	0,29
DECOMPOSERS	0,61	0,76	0,39	0,63	0,84	0,61	0,41	0,34	0,56	0,56	0,63
ROLE OF TREES	1,21	1,32	0,91	0,73	0,78	0,90	0,66	0,68	1,28	1,06	1,07
FOOD CHAINS	1,50	1,96	0,57	1,33	1,96	2,36	1,87	0,95	2,23	2,03	1,88
EROSION	0,72	0,42	0,61	0,17	0,61	1,10	1,05	0,49	1,22	1,06	0,66
POLLUTION	2,04	1,32	2,43	0,98	2,32	2,58	2,42	0,79	2,58	2,47	1,86
DEFORESTATION	1,98	2,26	0,26	0,90	2,32	2,74	2,18	0,89	2,61	2,59	1,77
PLANT INVADERS	0,08	0,10	0,04	0,00	0,05	0,36	0,17	0,00	0,19	0,59	0,04
ENDANGERED SPECIES	0,68	0,51	0,78	0,04	1,21	1,61	1,37	0,04	1,44	1,94	0,59

THE MEAN TOTAL PERCEPTION (C + V) SCORES IN THE PRE-TEST FOR EACH OF THE ELEVEN SCHOOLS

APPENDIX B-4(c)

CONT. : N = 143 EXP. : N = 185		COGNITIONS								VALUES							
		0		1		2		3		0		1		2		3	
		PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST
SOIL	CONT.	90,2	93,7	8,4	5,6	1,4	0,7	0	0	82,5	90,2	16,8	8,4	0,7	1,4	0	0
	EXP.	88,6	81,6	8,1	13,5	3,2	4,3	0	0,5	82,2	88,6	17,3	27,8	0,5	3,8	0	0
WATER	CONT.	86,7	88,8	9,8	9,1	3,5	2,1	0	0	78,3	76,2	18,9	23,1	2,8	0,7	0	0
	EXP.	90,8	82,7	8,1	13,0	1,1	4,3	0	0	84,9	84,9	13,0	31,4	2,2	3,8	0	0
DROUGHT	CONT.	32,2	22,4	40,6	63,6	25,9	13,3	1,4	0,7	66,4	60,8	28,0	31,5	4,9	7,7	0,7	0
	EXP.	39,5	25,9	42,7	49,7	17,8	17,3	0	7,0	69,7	49,7	26,5	40,5	3,2	8,6	0,5	1,1
DEPENDENCY	CONT.	37,1	28,7	7,7	4,2	39,9	45,5	15,4	21,7	65,0	58,7	35,0	39,2	0	2,1	0	0
	EXP.	39,5	24,5	6,5	4,9	33,5	44,3	20,5	26,5	70,8	44,9	24,9	48,1	4,3	7,0	0	0
ADAPTATIONS	CONT.	93,0	83,2	1,4	10,5	2,1	4,2	3,5	2,1	95,8	93,0	2,8	4,9	1,4	2,1	0	0
	EXP.	88,1	77,3	3,8	5,9	5,4	8,1	2,7	8,6	98,4	87,0	1,1	9,2	0,5	3,8	0	0
DECOMPOSERS	CONT.	55,9	71,3	39,9	28,0	3,5	0,7	0,7	0	87,4	88,8	12,6	10,5	0	0,7	0	0
	EXP.	83,2	65,4	34,8	28,5	1,1	7,6	1,1	0,5	87,6	86,5	10,8	8,6	1,6	4,9	0	0
ROLE OF TREES	CONT.	57,3	51,7	28,6	28,7	14,7	19,6	1,4	0	75,5	68,5	16,8	22,4	7,7	9,1	0	0
	EXP.	49,2	42,2	35,7	29,7	14,1	25,9	1,1	2,2	65,4	49,7	29,7	35,1	4,9	15,1	0	0
FOOD CHAINS	CONT.	5,6	4,2	62,2	51,7	16,1	17,5	16,1	26,6	43,4	31,5	50,3	67,1	5,6	1,4	0,7	0
	EXP.	5,9	5,4	62,2	48,2	17,8	16,8	14,1	28,8	41,6	31,9	52,4	58,9	5,9	9,2	0	0
EROSION	CONT.	72,7	58,7	3,5	4,2	21,7	35,7	2,1	1,4	79,0	71,3	18,8	17,5	4,2	11,2	0	0
	EXP.	83,2	42,7	5,4	4,3	30,3	50,3	1,1	2,7	71,9	51,9	17,3	25,4	9,7	21,6	1,1	1,1
POLLUTION	CONT.	2,1	0	60,8	70,6	36,4	28,7	0,7	0,7	3,5	2,8	68,5	76,2	28,0	21,0	0	0
	EXP.	4,3	1,1	67,6	56,2	27,0	41,1	1,1	1,6	7,0	4,3	71,4	64,9	21,6	30,8	0	0
DEFORESTA-TION	CONT.	8,3	3,5	47,8	55,2	41,3	28,0	4,9	13,3	30,1	28,7	41,3	57,3	28,7	14,0	0	0
	EXP.	7,6	1,6	50,8	45,9	28,6	27,0	13,0	25,4	28,6	19,5	47,0	51,9	23,8	26,5	0,5	2,2
PLANT INVADERS	CONT.	95,8	92,3	0	3,5	1,4	2,8	2,8	1,4	95,8	93,0	2,8	5,6	1,4	1,4	0	0
	EXP.	92,4	91,4	2,2	1,6	3,2	2,7	2,2	4,3	96,2	92,4	2,2	4,3	1,6	3,2	0	0
ENDANGERED SPECIES	CONT.	67,1	62,2	2,8	1,4	27,3	32,2	2,8	4,2	54,5	44,1	27,3	23,8	17,5	31,5	0,7	0,7
	EXP.	68,1	43,2	1,6	3,8	28,6	47,8	1,6	5,4	62,2	31,9	18,9	19,5	18,9	48,1	0	0,5
TOTAL	CONT.	54,0	50,8	23,9	25,9	18,0	17,8	4,0	5,5	65,9	62,1	26,0	29,8	7,9	8,0	0,2	0,1
	EXP.	53,9	45,9	25,3	23,4	16,3	22,9	4,5	8,7	66,6	52,6	25,6	32,7	7,6	14,3	0,2	0,4

FREQUENCIES OF CODES (AS PERCENTAGES) FOR COGNITIONS AND VALUES, CONTROL AND EXPERIMENTAL GROUPS : PRE- VERSUS POST-TEST

APPENDIX B-4(d)

CONT. : N = 143 EXP. : N = 185		COGNITIONS							VALUES						
		-3	-2	-1	0	1	2	3	-3	-2	-1	0	1	2	3
SOIL	CONT.	-	-	11	127	5	-	-	-	-	21	112	9	1	-
	EXP.	-	3	9	149	17	6	1	-	-	17	124	40	4	-
WATER	CONT.	-	3	7	128	6	1	-	-	1	20	100	22	-	-
	EXP.	-	-	9	151	20	5	-	-	-	14	122	44	5	-
DROUGHT	CONT.	-	6	34	87	32	4	-	1	5	16	87	29	5	-
	EXP.	-	4	23	95	49	10	4	-	4	17	102	52	8	2
DEPENDENCY	CONT.	2	7	12	80	21	14	7	-	-	18	97	28	2	-
	EXP.	2	8	24	92	28	19	16	-	5	13	97	64	8	-
ADAPTATIONS	CONT.	-	4	3	120	10	4	2	-	1	1	135	4	2	-
	EXP.	4	5	5	136	10	11	14	-	-	3	159	16	7	-
DECOMPOSERS	CONT.	-	3	32	98	10	-	-	-	-	12	121	9	1	-
	EXP.	-	1	33	118	25	8	-	-	-	16	150	14	5	-
ROLE OF TREES	CONT.	1	4	29	73	21	15	-	-	5	16	92	22	8	-
	EXP.	-	12	27	78	47	20	1	-	1	22	104	44	14	-
FOOD CHAINS	CONT.	-	5	15	82	24	16	1	-	3	27	72	40	1	-
	EXP.	-	5	26	94	33	25	2	-	2	34	92	52	5	-
EROSION	CONT.	1	2	8	104	5	21	2	-	2	13	99	20	9	-
	EXP.	-	8	4	114	17	42	-	-	2	7	118	47	10	1
POLLUTION	CONT.	-	1	34	81	26	1	-	-	1	33	84	24	1	-
	EXP.	-	1	24	103	54	3	-	-	-	27	112	43	3	-
DEFORESTATION	CONT.	-	6	30	85	33	9	-	-	2	43	74	20	4	-
	EXP.	-	5	22	95	42	19	2	-	4	37	81	53	10	-
PLANT INVADERS	CONT.	1	2	1	131	5	3	-	-	1	3	132	5	2	-
	EXP.	-	2	4	170	4	2	3	-	1	2	172	6	4	-
ENDANGERED SPECIES	CONT.	-	10	8	99	7	18	1	-	4	19	76	26	18	-
	EXP.	-	14	4	101	10	51	5	-	5	9	88	36	46	1

FREQUENCIES OF INDIVIDUAL △-SCORES (IN RANGE -3 TO +3) FOR EACH OF THE CONCEPTS IN THE COGNITIONS AND VALUES CATEGORIES FOR CONTROL AND EXPERIMENTAL GROUPS

APPENDIX B-5(a)

```
=========================
Hierdie lêer:  MANOVA.OUT
DATA:        FINALDAT.SYS
DATUM:           90.04.20
=========================

INSTRUKSIES:

   DATAVOORBEREIDING

get 'A:data.daa'
save 'g:data.sys'

INPUT  (PRE,V6,V7,V8,V9,V10,V11,V12,V13,V14,V15,
            V16,V17,V18,V19,V20,V21,V22,V23,V24,V25,
            V26,V27,V28,V29,V30,V31,
        V36,V37,V38,V39,
            V40,V41,V42,V43,V44,V45,V46,V47,V48,V49,
            V50,V51,V52,V53,V54,
       POST,V106,V107,V108,V109,V110,V111,V112,V113,V114,V115,
            V116,V117,V118,V119,V120,V121,V122,V123,V124,V125,
            V126,V127,V128,V129,V130,V131,
       V136,V137,V138,V139,
            V140,V141,V142,V143,V144,V145,V146,V147,V148,V149,
            V150,V151,V152,V153,V154),

     (6*÷,£1,^11,26*£2/4*÷,18*£1,£2/6*÷,£1,^11,26*£2/4*÷,18*£1,£2)
run

BEREKEN DIE FINALE VERANDERLIKES
--------------------------------
use 'g:data.sys'
save finaldat
Let   KYKPRE=V6+V8+V10+V12+V14+V16+V18+V20+V22+V24+V26+V28+V30
Let   VOELPRE=V7+V9+V11+V13+V15+V17+V19+V21+V23+V25+V27+V29+V31
Let   AKTPRE=V36+V37+V38+V39+V40+V41+V42+V43+V44+V45+V46+V47+V48,
             +V49+V50+V51+V52+V53
Let   KYKPOST=V106+V108+V110+V112+V114+V116+V118+V120+V122+V124,
      +V126+V128+V130
Let   VOELPOST=V107+V109+V111+V113+V115+V117+V119+V121+V123+V125,
      +V127+V129+V131
Let   AKTPOST=V136+V137+V138+V139+V140+V141+V142+V143+V144+V145,
      +V146+V147+V148+V149+V150+V151+V152+V153

Let   DIFKYK=KYKPOST-KYKPRE
Let   DIFVOEL=VOELPOST-VOELPRE
Let   DIFAKT=AKTPOST-AKTPRE

DROP V6-V53,POST,V106-V153

run
```

```
 BASIESE STATISTIEKE EN MANOVA
 -----------------------------
Opmerking: Ek het op hierdie stadium die veranderlike
wat oorspronklik "PRE" geheet het, herbenaam tot "GROEP"

use finaldat
output 'a:manova.out'
   by groep
   print long
statistics kykpre, voelpre, aktpre, kykpost, voelpost, aktpost,
           difkyk, difvoel, difakt

 switchto mglh
        by
        print short
  note 'PRE: VERSKIL TUSSEN GROEPE 1 EN 2'
    category groep=2
    model  KYKPRE VOELPRE AKTPRE = constant+groep

            estimate
            hypothesis
            effect=groep
            test

   note 'POST: VERSKIL TUSSEN GROEPE 1 EN 2'
      category groep=2
      model KYKPOST VOELPOST AKTPOST = constant + groep

             estimate
             hypothesis
             effect=groep
             test

   NOTE  'VERGELYKING VAN GROEPE 1 EN 2 TEN OPSIGTE VAN'
   NOTE  'DIE  VERSKILLE TUSSEN  PRE  EN  POST-TELLINGS'
      category groep=2
      model DIFKYK DIFVOEL DIFAKT = constant + groep
             estimate
             hypothesis
             effect=groep
             test
```

==========

THE FOLLOWING RESULTS ARE FOR:
GROEP = 1.0000

TOTAL OBSERVATIONS: 185

	KYKPRE	VOELPRE	AKTPRE	KYKPOST	VOELPOST
N OF CASES	185	185	185	185	185
MINIMUM	1.0000	0.0000	4.0000	2.0000	0.0000
MAXIMUM	19.0000	14.0000	34.0000	23.0000	18.0000
MEAN	9.2811	5.3676	22.3622	12.3946	8.1297
STANDARD DEV	3.7831	3.1373	5.6283	4.5242	3.9030

	AKTPOST	DIFKYK	DIFVOEL	DIFAKT
N OF CASES	185	185	185	185
MINIMUM	4.0000	-5.0000	-6.0000	-25.0000
MAXIMUM	34.0000	13.0000	11.0000	17.0000
MEAN	23.0270	3.1135	2.7622	0.6649
STANDARD DEV	6.4111	3.7983	3.1584	5.7650

THE FOLLOWING RESULTS ARE FOR:
GROEP = 2.0000

TOTAL OBSERVATIONS: 143

	KYKPRE	VOELPRE	AKTPRE	KYKPOST	VOELPOST
N OF CASES	143	143	143	143	143
MINIMUM	2.0000	1.0000	0.0000	2.0000	0.0000
MAXIMUM	19.0000	13.0000	35.0000	18.0000	15.0000
MEAN	9.3636	5.4965	22.4336	10.1399	5.9790
STANDARD DEV	3.4305	2.6981	6.5473	3.5615	2.5769

	AKTPOST	DIFKYK	DIFVOEL	DIFAKT
N OF CASES	143	143	143	143
MINIMUM	2.0000	-10.0000	-7.0000	-21.0000
MAXIMUM	33.0000	9.0000	8.0000	27.0000
MEAN	22.2308	0.7762	0.4825	-0.2028
STANDARD DEV	6.0569	3.2184	2.7702	6.5408

SUMMARY STATISTICS FOR KYKPRE

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 1.515 DF= 1 PROBABILITY = .218

OVERALL MEAN = 9.3171 STANDARD DEVIATION = 3.6284
POOLED WITHIN GROUPS STANDARD DEVIATION = 3.6337
T STATISTIC = .204 PROBABILITY = .838

SUMMARY STATISTICS FOR VOELPRE

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 3.574 DF= 1 PROBABILITY = .059

OVERALL MEAN = 5.4238 STANDARD DEVIATION = 2.9502
POOLED WITHIN GROUPS STANDARD DEVIATION = 2.9540
T STATISTIC = .392 PROBABILITY = .695

SUMMARY STATISTICS FOR AKTPRE

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 3.689 DF= 1 PROBABILITY = .055

OVERALL MEAN = 22.3933 STANDARD DEVIATION = 6.0367
POOLED WITHIN GROUPS STANDARD DEVIATION = 6.0458
T STATISTIC = .106 PROBABILITY = .916

SUMMARY STATISTICS FOR KYKPOST

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 8.881 DF= 1 PROBABILITY = .003

OVERALL MEAN = 11.4116 STANDARD DEVIATION = 4.2755
POOLED WITHIN GROUPS STANDARD DEVIATION = 4.1325
T STATISTIC = 4.900 PROBABILITY = .000

SUMMARY STATISTICS FOR VOELPOST

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 25.899 DF= 1 PROBABILITY = .000

OVERALL MEAN = 7.1921 STANDARD DEVIATION = 3.5491
POOLED WITHIN GROUPS STANDARD DEVIATION = 3.3897
T STATISTIC = 5.698 PROBABILITY = .000

SUMMARY STATISTICS FOR AKTPOST

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = .513 DF= 1 PROBABILITY = .474

OVERALL MEAN = 22.6799 STANDARD DEVIATION = 6.2622
POOLED WITHIN GROUPS STANDARD DEVIATION = 6.2593
T STATISTIC = 1.142 PROBABILITY = .254

SUMMARY STATISTICS FOR DIFKYK

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 4.306 DF= 1 PROBABILITY = .038

OVERALL MEAN = 2.0945 STANDARD DEVIATION = 3.7368
POOLED WITHIN GROUPS STANDARD DEVIATION = 3.5574
T STATISTIC = 5.901 PROBABILITY = .000

SUMMARY STATISTICS FOR DIFVOEL

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 2.711 DF= 1 PROBABILITY = .100

OVERALL MEAN = 1.7683 STANDARD DEVIATION = 3.1980
POOLED WITHIN GROUPS STANDARD DEVIATION = 2.9955
T STATISTIC = 6.835 PROBABILITY = .000

SUMMARY STATISTICS FOR DIFAKT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 2.569 DF= 1 PROBABILITY = .109

OVERALL MEAN = 0.2866 STANDARD DEVIATION = 6.1209
POOLED WITHIN GROUPS STANDARD DEVIATION = 6.1150
T STATISTIC = 1.274 PROBABILITY = .203

PRE: VERSKIL TUSSEN GROEPE 1 EN 2

NUMBER OF CASES PROCESSED: 328

DEPENDENT VARIABLE MEANS

KYKPRE	VOELPRE	AKTPRE
9.3171	5.4238	22.3933

ESTIMATES OF EFFECTS $B = (X'X)^{-1} X'Y$

		KYKPRE	VOELPRE	AKTPRE
CONSTANT		9.3224	5.4320	22.3979
GROEP	1	-0.0413	-0.0645	-0.0357

SQUARED MULTIPLE CORRELATIONS

KYKPRE	VOELPRE	AKTPRE
0.0001	0.0005	0.0000

TEST FOR EFFECT CALLED:
GROEP

UNIVARIATE F TESTS

VARIABLE	SS	DF	MS	F	P
KYKPRE	0.5497	1	0.5497	0.0416	0.8385
ERROR	4304.4747	326	13.2039		
VOELPRE	1.3409	1	1.3409	0.1537	0.6953
ERROR	2844.7537	326	8.7262		
AKTPRE	0.4112	1	0.4112	0.0113	0.9156
ERROR	11915.8540	326	36.5517		

MULTIVARIATE TEST STATISTICS

WILKS' LAMBDA =	0.9995				
F-STATISTIC =	0.0543	DF =	3, 324	PROB =	0.9833
PILLAI TRACE =	0.0005				
F-STATISTIC =	0.0543	DF =	3, 324	PROB =	0.9833
HOTELLING-LAWLEY TRACE =	0.0005				
F-STATISTIC =	0.0543	DF =	3, 324	PROB =	0.9833

POST: VERSKIL TUSSEN GROEPE 1 EN 2

NUMBER OF CASES PROCESSED: 328

DEPENDENT VARIABLE MEANS

KYKPOST	VOELPOST	AKTPOST
11.4116	7.1921	22.6799

ESTIMATES OF EFFECTS $B = (X'X)^{-1} X'Y$

		KYKPOST	VOELPOST	AKTPOST
CONSTANT		11.2672	7.0544	22.6289
GROEP	1	1.1274	1.0754	0.3981

SQUARED MULTIPLE CORRELATIONS

KYKPOST	VOELPOST	AKTPOST
0.0686	0.0906	0.0040

TEST FOR EFFECT CALLED:
GROEP

UNIVARIATE F TESTS

VARIABLE	SS	DF	MS	F	P
KYKPOST	410.0386	1	410.0386	24.0099	0.0000
ERROR	5567.3974	326	17.0779		
VOELPOST	373.0758	1	373.0758	32.4689	0.0000
ERROR	3745.8235	326	11.4903		
AKTPOST	51.1377	1	51.1377	1.3052	0.2541
ERROR	12772.2495	326	39.1787		

MULTIVARIATE TEST STATISTICS

WILKS' LAMBDA =	0.9073				
F-STATISTIC =	11.0320	DF =	3, 324	PROB =	0.0000
PILLAI TRACE =	0.0927				
F-STATISTIC =	11.0320	DF =	3, 324	PROB =	0.0000
HOTELLING-LAWLEY TRACE =	0.1021				
F-STATISTIC =	11.0320	DF =	3, 324	PROB =	0.0000

VERGELYKING VAN GROEPE 1 EN 2 TEN OPSIGTE VAN
DIE VERSKILLE TUSSEN PRE EN POST-TELLINGS
==========

NUMBER OF CASES PROCESSED: 328

DEPENDENT VARIABLE MEANS

DIFKYK	DIFVOEL	DIFAKT
2.0945	1.7683	0.2866

ESTIMATES OF EFFECTS $B = (X'X)^{-1} X'Y$

	DIFKYK	DIFVOEL	DIFAKT
CONSTANT	1.9449	1.6223	0.2310
GROEP 1	1.1686	1.1398	0.4338

SQUARED MULTIPLE CORRELATIONS

DIFKYK	DIFVOEL	DIFAKT
0.0965	0.1253	0.0050

TEST FOR EFFECT CALLED:
GROEP

UNIVARIATE F TESTS

VARIABLE	SS	DF	MS	F	P
DIFKYK	440.6147	1	440.6147	34.8181	0.0000
ERROR	4125.4554	326	12.6548		
DIFVOEL	419.1488	1	419.1488	46.7115	0.0000
ERROR	2925.2414	326	8.9731		
DIFAKT	60.7205	1	60.7205	1.6238	0.2035
ERROR	12190.3405	326	37.3937		

MULTIVARIATE TEST STATISTICS

WILKS' LAMBDA =	0.8558				
F-STATISTIC =	18.1989	DF =	3, 324	PROB =	0.0000
PILLAI TRACE =	0.1442				
F-STATISTIC =	18.1989	DF =	3, 324	PROB =	0.0000
HOTELLING-LAWLEY TRACE =	0.1685				
F-STATISTIC =	18.1989	DF =	3, 324	PROB =	0.0000

APPENDIX B-5(b)

```
PC-PLUM      Teacher's data

UNITS =  2   CATEGORIES =  4   COVARIATES =  1
  35.00  64.00  38.00  48.00  -1.00
  29.00  54.00  36.00  24.00   1.00
NOTE Fit model of no association.
 Teacher's data
        DEVIANCE          DF.  SIG.LEVEL  CYCLE  LINK
      4.2281733             3      .2379      1  LOGIT
NOTE Compare groups
VARS. IN LOCATION MODEL  1
 Teacher's data
        DEVIANCE          DF.  SIG.LEVEL  CYCLE  LINK
      2.7694840             2      .2504      4  LOGIT
DIFFERENTIAL DEVIANCE     DF.  SIG.LEVEL
      1.4586894             1      .2271
 PARAMETER   ESTIMATE   ST.ERROR ALIAS   XBAR    EST./S.E.
 Theta1     -.1408D+01   .140D+00
 Theta2      .2321D+00   .112D+00
 Theta3      .1284D+01   .135D+00
 TrtvsCtrl -.1209D+00   .101D+00        .000        -1.2 -->
UNIT LOCATION SCALE DEV/UNIT  STANDARDISED RESIDUALS
   1    .121  1.000    1.158   .39  -.10  -.92   .68
   2   -.121  1.000    1.612  -.39   .16  1.05  -.88
OBSERVED AND FITTED VALUES
   35.00   64.00   38.00   48.00  185.00
   32.96   64.68   43.32   44.04
   29.00   54.00   36.00   24.00  143.00
   30.94   53.05   30.84   28.17
BEFORE    terminated  at  17:52:03    on  11-23-89


PC-PLUM      Teacher's data

UNITS =  2   CATEGORIES =  4   COVARIATES =  1
  38.00  41.00  37.00  27.00  -1.00
  86.00  30.00  47.00  22.00   1.00
NOTE Fit model of no association.
 Teacher's data
        DEVIANCE          DF.  SIG.LEVEL  CYCLE  LINK
     17.097620              3      .0007      1  LOGIT
NOTE Compare groups
VARS. IN LOCATION MODEL  1
 Teacher's data
        DEVIANCE          DF.  SIG.LEVEL  CYCLE  LINK
      8.3892960             2      .0151      4  LOGIT
DIFFERENTIAL DEVIANCE     DF.  SIG.LEVEL
      8.7083236             1      .0032
 PARAMETER   ESTIMATE   ST.ERROR ALIAS   XBAR    EST./S.E.
 Theta1     -.5329D+00   .116D+00
 Theta2      .3650D+00   .114D+00
 Theta3      .1733D+01   .156D+00
 TrtvsCtrl -.2974D+00   .102D+00        .000        -2.9 -->
UNIT LOCATION SCALE DEV/UNIT  STANDARDISED RESIDUALS
   1    .297  1.000    4.498  -.98  2.14  -.85  -.10
   2   -.297  1.000    3.892   .64 -1.85   .98   .12
OBSERVED AND FITTED VALUES
   38.00   41.00   37.00   27.00  143.00
   43.41   30.50   41.60   27.49
   86.00   30.00   47.00   22.00  185.00
   81.66   40.41   41.47   21.47
TEACHER   terminated  at  17:43:54    on  11-23-89
```